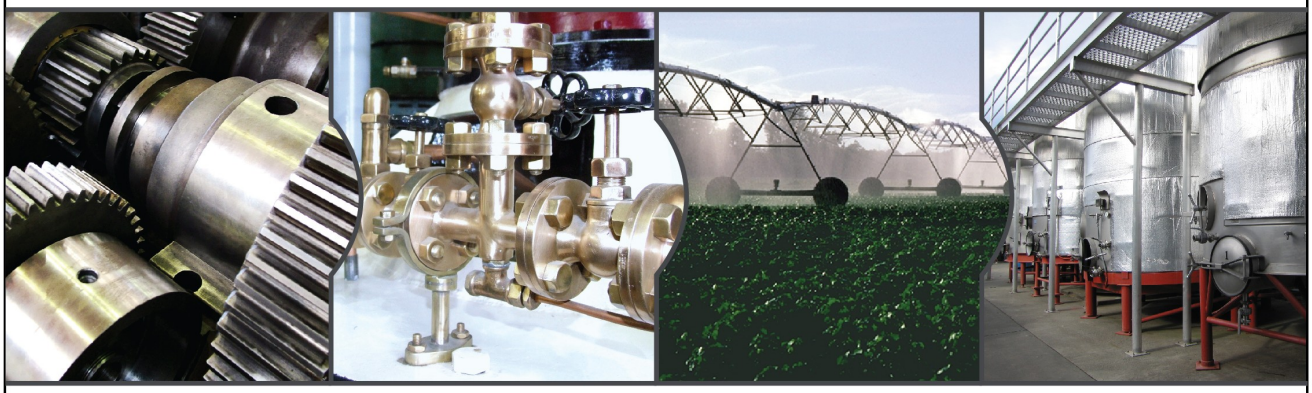
X332 Users Manual

Models: X-332-24I

Revision 1.5



Advanced Control & Monitoring via Network

16 Relays • 16 Digital Inputs • 2 Counter Inputs • 4 Analog Inputs • 1-Wire Bus for Temp/Humidity

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Control up to 16 Remote Relays

Email Notifications

BASIC Scripting

Logging

Scheduling

Real-Time Clock

CONTROL by WEB™

www.ControlByWeb.com

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Nibley, Utah, USA

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FCC Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

Warning

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause interference to radio communications. There is no guarantee, however, that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into a relay on a circuit different from where the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Notice

Changes or modification not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

Installation Guidelines (Read Before Installing)

- This unit must be installed by qualified personnel.
- This unit must not be installed directly outdoors.
- This unit must not be used for medical, life saving purposes, or for any purpose where its failure could cause serious injury or the loss of life.
- This unit must not be used in any way where its function or failure could cause significant loss or property damage.

Security Notes

X-332™ does not employ a general purpose computer operating system and does not have features, such as telnet, FTP, SSH, nor uncontrolled open ports. This means it is unlikely for someone to 'break in' to X-332™ and access other devices on your local network. The simplicity of X-332™ makes it a inherently secure device. Nevertheless, as with any device installed on a network, appropriate security precautions should be observed.

If X-332™ is installed on the Internet, it is recommended that passwords be enabled for the **Control Page**. Passwords should be at least 8 characters in length and use a combination of upper and lower case letters and numbers. For additional security, a firewall may be used to limit access to selected IP addresses. Another option may be to set up a Virtual Private Network (VPN) between the network where X-332™ resides and the client machine (web browser, another, ControlByWeb™ product, etc.).

Final Installation Notes

This ControlByWeb™ product supports connection to *10 Mbps* and *100 Mbps* networks. Although *100 Mbps* networks are faster, the amount of data transferred to and from this device is very minimal and little, if any, performance increase will be gained by setting it to *100 Mbps*. There are advantages, however, to operate this device at *10 Mbps*. At *10 Mbps*, less power is required, the unit runs cooler, and the lifetime of the product will be extended.

Any changes to the Ethernet settings will require a removing and re-applying power to X-332™.

Section 1: Introduction

X-332™ is a multi-function web-enabled module for control and monitoring. The X-332™ includes sixteen dry-contact relays, sixteen optically-isolated digital inputs, two counter inputs (inputs 17 and 18), four analog inputs and 1-wire bus with support for up to 4 temperature/humidity sensors. It can be controlled and/or monitored over any IP network including private networks, IP-based industrial control networks, and the Internet. Users can operate the X-332™ using a web browser, or custom applications can be written to control the X-332™ from a computer, PLC, or other automation controller. In addition, custom control scripts can be written and executed using BASIC programming language.

Other outstanding features of other ControlByWeb products are also included, such as email notification, BASIC scripting, scheduling, and logging. The X-332™ can also control up to 16 remote relays and can graph logged data with any HTML 5 compliant web browser.

The X-332™ supports a number of protocols, including HTTP, XML, Modbus/TCP, SNMP, SMTP, NTP, and Remote Services.

Figure 1.1 - Product Image

1.1 X-332™ Features

Relay Outputs (16)

Control relays with a web browser, timers, input changes, or programmable logic. The relays are isolated from all other circuitry in the device and from each other.

Digital Inputs (16)

View state of inputs with a web browser. Inputs are optically isolated and can be used for 28 volt industrial sensors. Use inputs to control relays, trigger email messages.

Counter Inputs (2)

Two discrete, 5V counter inputs (inputs 17 and 18). These inputs are considered “On” when asserted low, and can also be used as counters.

One-Wire bus (connect up to four temperature/humidity sensors)

Monitor temperature and/or humidity sensors - control relays or trigger email messages based upon temperature and humidity values.

Analog Inputs (4)

Monitor analog inputs. Control relays or trigger email messages based upon the analog reading. Each analog input has a 0 to 5 volt range, and offers 12 bits of resolution.

Remote Relays

Control relays on other ControlByWeb products.

Real-time Clock

Manual or NTP capability.

Event Scheduler

Program up to 100 control events based on time and date conditions.
Automatically switch from weekday to weekend or holiday schedules.

Logging

Configurable logging of digital inputs, temperature, humidity, analog inputs, and relay states.
System logging of device operating parameters and events, such as power reset and NTP requests.

Graphing

Logged data can be graphed directly inside any HTML 5 compatible web browser.

Email Notification

Send email alerts based on any sensor or input conditions, such as temperature, time, digital inputs, analog inputs, and more. Send text messages (using a wireless carrier's email bridge).

BASIC Script

Additional flexibility is provided through custom scripts using a BASIC interpreter.

Built-in Web Server

All configuration is done through the built-in, password protected web server.

1.2 Applications

X-332™ was designed to meet a broad range of industrial applications. It works very well as a standalone device that can be controlled using a web browser, or as a convenient way to add I/O to a computer. It can easily be configured using simple menus and drop-down lists, or it can run simple BASIC scripts. Many of its features such as scheduling, logging, input state monitoring, and the ability to control up to 32 relays (16 internal and 16 remote relays on other devices) make the X-332™ a very powerful, yet simple controller.

You can use the X-332™ to control motors, lights, coils, pumps, valves, bells, etc. You can also use it to monitor alarms sensors, switches, fluid level switches, battery voltage, temperature, humidity, and much more. A few example applications include:

- Bell Controller
- I/O Extender
- Industrial Thermostat
- Solar Energy Controller
- Process Controller
- Process Monitor

1.3 X-332™ Models Available

Part Number	Power Supply Requirements
X-332-24I	9-28VDC

1.3.1 Optional Accessories

Accessory	Description	Part Number
DIN-Rail Power Supply	*Output :* 24V DC, 1.75Amp *Input Voltage:* 100-240V AC, Input Frequency: 45-66 Hz	2868648
Temperature Sensor	Digital temperature sensor with 3-foot wire leads. Note: Leads may be extended	X-DTS-S3C
Temperature Sensor (Wall Mount)	Digital temperature sensor housed in vented plastic enclosure	X-DTS-WM
Temperature/Humidity Sensor (Wall Mount)	Digital temperature and humidity sensor housed in vented plastic enclosure	X-DTHS-WM
DIN Rail Mounting Clips	Removable mounting clips to attach the X-332 to a DIN rail.	DRC-12C

1.4 Connectors & Indicators

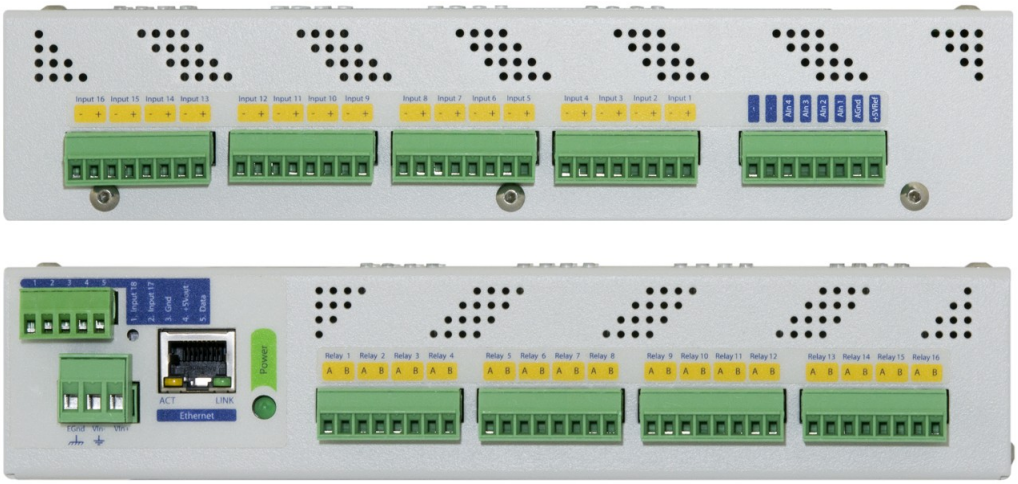


Figure 1.4a - Connections & Indicators

I/O Connectors

X-332™ has nine 8-position removable screw terminal connectors, one 5-position removable screw terminal connector, one 3-position removable screw terminal connectors and an Ethernet connector.

These connectors are used to connect relay contacts, digital inputs, counters, analog inputs, power and network.

Network Connector

The Ethernet connector is a standard, 8-position modular receptacle.

Module Power Indicator

The green Power LED indicator is illuminated whenever the module is powered.

Relay Indicators

Sixteen green LEDs illuminate when the corresponding relays are energized (when a relay is energized, the common and normally open contacts are closed).

Optically-Isolated Digital Input Indicators

Sixteen green LEDs illuminate when a voltage is applied to the corresponding optically-isolated digital inputs.

Ethernet Indicators

The LINK LED is illuminated green when the module is properly connected to an Ethernet network and is ready to communicate. Network communications will only occur if this LED is illuminated. The ACT LED flashes yellow when activity is detected on the network.

1.5 Accessing X-332™

Standard Access Using a Web Browser

X-332™ has a built-in web server that provides simple web pages that can be accessed directly using a standard web browser. This allows users to access the unit with NO SPECIAL SOFTWARE installed on their computer. This is ideal for applications that require a quick, simple solution that does not need to be accessible to more than a few people. This configuration is simple to setup, simple to use, and can be accessed from just about any computer or smart phone.

*Note: Network routers may need to be configured to allow access from computers outside of the local network (see **Appendix C: Accessing X-332™ Over The Internet**).*

Section 2: Installation and Setup

Installation consists of mounting the X-332™, connecting it to an Ethernet network, providing power, and configuring via a web browser, wiring the relays, digital inputs, analog inputs and temperature and/or humidity sensors.

2.1 Mounting

X-332™ can sit on a shelf or be mounted to a wall or DIN Rail (35mm by 7.55mm). It should be mounted in a clean, dry location where it is protected from the elements. Ventilation is recommend for installations where ambient air temperatures are expected to be high

See **Appendix J: Mechanical Information** for additional mechanical details.

2.1.1 Shelf Installation

When sitting the X-332™ on a shelf, attach the self-adhesive rubber feet to the bottom of the X-332™, and place on a shelf or flat surface.

2.1.2 Wall Mounting

Omit/remove the rubber feet, attach the wall mount bracket (shown below) to the side of the X-332™ by using two #6 screws. Mount the X-332™ to a wall by using two additional #6 screws. Repeat steps for additional wall mount.

Wall mount brackets

2.1.3 DIN-Rail Mounting

Attach a wall mount bracket (shown above) to the side of the X-332™ by using two #6 screws. Attach the DIN-Rail mounting clips [Part number DRC-12C sold separately] to the wall mount bracket by using two additional #6 screws (pictured below). Repeat for the additional DIN-Rail clip.

X-332™ mounted to a DIN-Rail using wall mount brackets and DIN-Rail mounting clips

DIN-Rail Mounting Clips

2.2 Connection

CAUTION: MAKE SURE POWER IS SHUT OFF BEFORE WIRING!

CAUTION: THIS UNIT SHOULD BE INSTALLED BY A QUALIFIED TECHNICIAN.

MIS-WIRING OR MIS-CONFIGURATION COULD CAUSE PERMANENT DAMAGE TO THE X-332™, THE EQUIPMENT TO WHICH IT IS CONNECTED, OR BOTH.

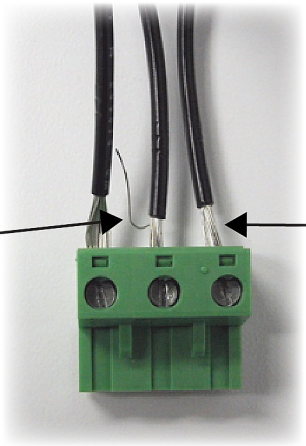
Removable terminal connectors are provided for simple wiring. The correct wiring procedure is as follows:

1. Make sure power is turned off.
2. Remove the terminal connector from the X-332™ and make wiring connections to the terminals.
3. Reconnect the terminal connector.
4. Apply power.

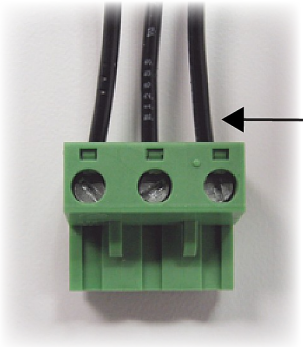
It is recommended that the load (device to be controlled) not be connected to the X-332™ until after the X-332™ has been configured and tested. By doing this, wiring and configuration mistakes will not cause the load device to turn on unexpectedly.

IMPORTANT: MAKE SURE WIRES ARE PROPERLY ATTACHED TO THE TERMINALS AND THAT THE TERMINALS ARE TIGHT!

Bad Connector Example



Good Connector Example



2.2.1 Power Supply Connection

3-pin Connector Pinout	
Pin	**Description**
Vin+	Power Supply VDC+ 9-28 VDC for model X-332-24I DO NOT EXCEED MAXIMUM POWER SUPPLY VOLTAGE.
Vin-	VDC- (Ground) power supply input.
Egnd	Earth ground *Important Note: Connect this to Earth ground.*

X-332™ requires power for its internal logic circuits. Connect a 9-28 VDC power supply to the Vin+ and Vin- terminals. Note that a regulated power supply is recommended. Verify that the power supply is rated for the operating current of X-332™ (See **Appendix H: Specifications** for current requirements.) Multiple X-332™ units may be connected to a single power supply by connecting the power supply input terminals in parallel. The power supply must have a high enough current rating to power all units connected. (See **Appendix H: Specification**s for current requirements.)

2.2.2 Relay Connection

The relay contacts are internally connected directly to the terminal connectors. Four relays are connected to each 8-pin connector. A Common contact (A) and Normally Open contact (B) are provided for each relay. The relay contacts may be wired in series with the power source for the load (device to be controlled) as long as the load does not exceed the maximum current and voltage rating of the relay contacts.

For loads greater than 2 Amps, an external interposer relay should be used. The illustration below (Figure 2.2a) shows how a 20-Amp motor can be controlled using an external relay. In the example, the X-332™ controls the external relay and the external relay controls the load.

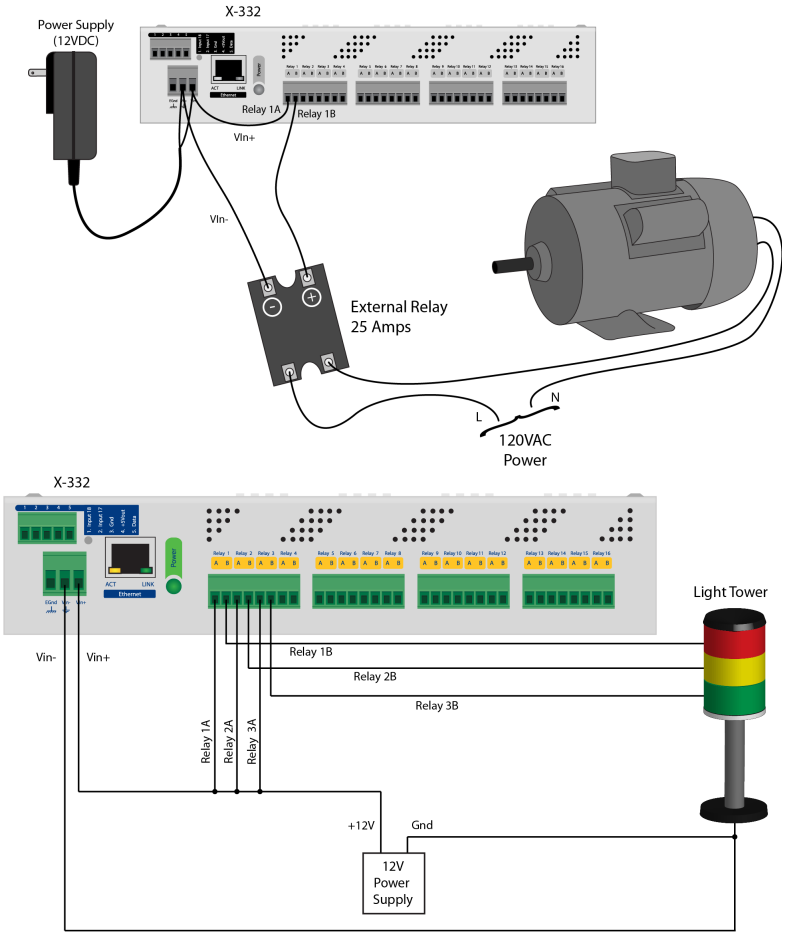


Figure 2.2a—External Relay Connections / Figure 2.2b-High Side Switch Wiring

When mechanical relays switch inductive loads such as motors, transformers, relays, etc., the current will arc across the internal relay contacts each time the contacts open. Over time, this causes wear on the relay contacts which can shorten their life span. When switching an inductive load, it is recommended that relay contact protection devices are used. Note that the X-332™ does include an internal MOV (40V) across its relay contacts, which offers some protection. Additional relay contact protection may be required. Below is an example of relay contact protection for a DC circuit (Figure 2.2c) and an AC circuit (Figure 2.2d). For component values required to provide sufficient contact protection for your application, refer to appropriate references.

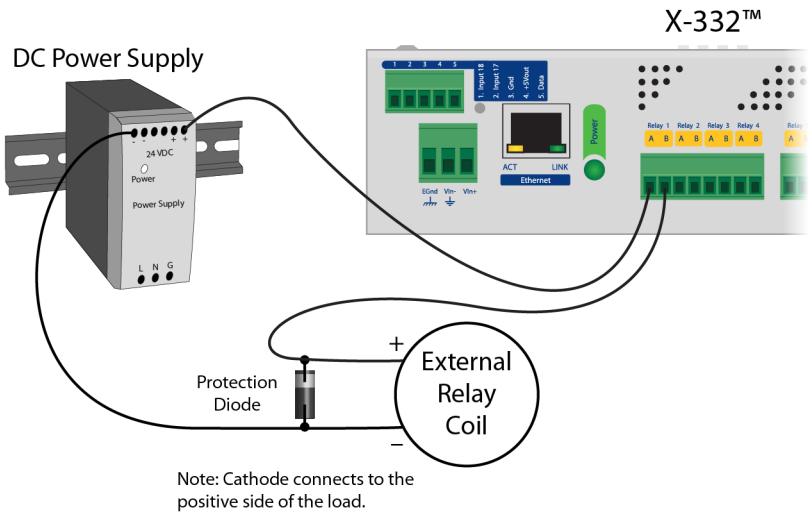


Figure 2.2c—DC Contact Protection

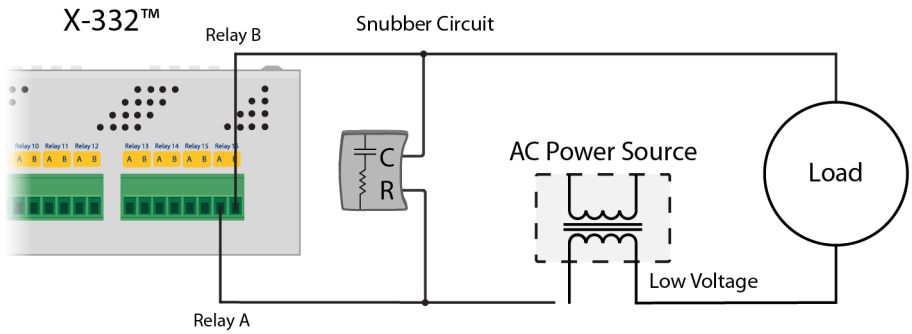


Figure 2.2d—AC Contact Protection

2.2.3 Optically-Isolated Input Connections

Internally each input connects directly to an opto-isolator. There are four optically isolated inputs connected to each 8-pin connector. The optically-isolated inputs can be used to control the internal relays, control remote relays (over the network), or simply to monitor the state of a discrete device. To use these inputs, connect a DC control voltage directly to the input and ground, and set up the function of the input using the configuration pages. A current limiting resistor is provided internally, so no external resistors are required as long as the maximum input voltage is not exceeded. If an AC signal, or a signal greater than the rated input voltage needs to be detected by the X-332™, use a signal conditioner to convert the signal to a DC signal within the input range.

Connecting "dry contacts" to the optically-isolated inputs:

Figure 2.2e illustrates how a dry contact switch can be connected to the input (or inputs) of the X-332™. One side of the contact is connected to Vout, and the other side is connected to In+. When the contact is closed, it applies 5V to the input terminals.

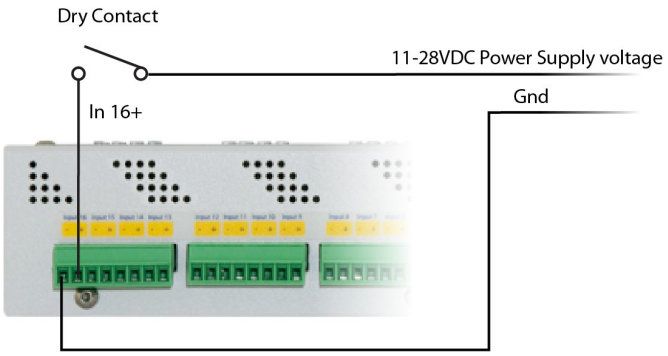


Figure 2.2e—Connecting Dry Contacts to the X-332™

Connecting voltages to the optically-isolated inputs:

AC Inputs:

If an AC signal voltage needs to be detected, use a signal conditioner to convert the AC signal to a DC voltage within the input range. An AC signal conditioner can be made using a diode (or bridge rectifier) and a capacitor. Prepackaged signal converters are available as accessories at industrial automation distributors. A simple voltage converter module manufactured by www.redlion.net is shown below. These are available in two input voltage ranges that cover the spectrum from 4-270VAC/DC. These devices have a MOSFET output (solid state DC contact closure) which is compatible with the X-310 input. The converter module accepts AC (50/60 Hz) or DC voltages at input cycles up to 30 Hz. The converter provides isolation between the input and output using an opto-isolator. You must provide a voltage source for the input of the X-332 as shown in the example below:

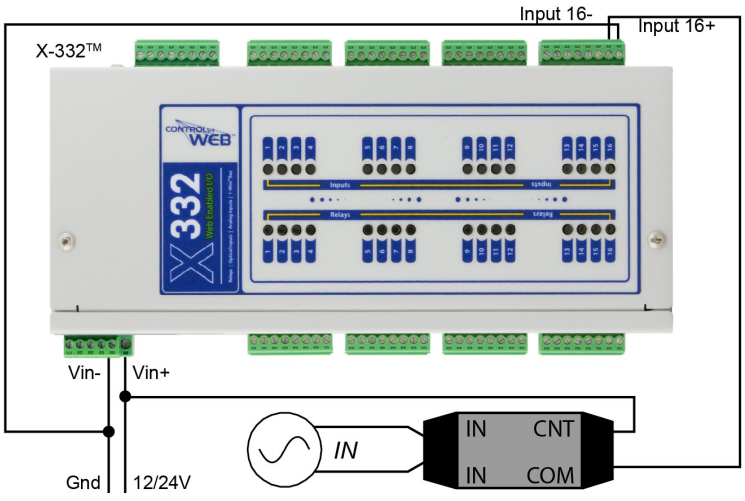


Figure 2.2f

DC Inputs:

With DC inputs, no external components are required as long as the maximum input voltage is not exceeded (See Specifications). A DC voltage can be reduced with an external resistor of the appropriate value and power rating to reduce the input current.

The formulas to calculate external resistor values are provided below:

X-332-24I with a **11-26VDC** input range has an internal 3K ohm resistor. The forward voltage drop of the photo-coupler is approximately 1.2V and works well with an input current of 10mA.

R =((Vin-1.2)/0.01)-3000

Where:

- R = External resistor value required
- Vin = Desired input voltage
- 1.2V = forward voltage drop of the LED in the photo coupler
- .01A = workable LED current
- 3000ohm = Internal resistor

For example:

To connect a 48VDC signal voltage to the X-332™ with a 11-26VDC input range:

R = ((48-1.2)/0.01)-3000 = 1680 Ohms (use a 1600 ohm resistor)

Check the power dissipated by the resistor:

P = I x I x R, The resistor must be at least .01 x .01 x 1600 = 0.16 Watts, so use a 1/2 Watt resistor

2.2.4 Temperature/Humidity Sensor and Counter Input Connection

5-pin Connector Pinout	
Pin	**Description**
1. Input 18	5V Counter Input
2. Input 17	5V Counter Input
3. Gnd	Ground connection for Discrete Inputs.
4. +5Vout	This output voltage is used to provide power for the digital temperature/humidity sensors
5. Data	Temperature/Humidity Data. This is the data line connection for the digital temperature/humidity sensors.

The 5-pin connector is used to connect temperature and humidity sensors, as well as to connect low voltage sensors. Inputs 17 and 18 found on the 5-pin connector can also be used as counters.

Temperature or humidity sensors can be used for monitoring environmental conditions. The digital sensors use a one-wire data bus, which allows up to four sensors to share the same terminals (+5V, Ground, Data). Every sensor on the one-wire bus is assigned a unique serial number when it is manufactured. That number is used to address the device during communication.
The sensors have three wires; the wire color is show in the table below.

Figure 2.2g - Temperature Sensor

Sensor Wire Color	**Connection**
Red	5V Out
Black	Gnd
Blue, White, Yellow	Data

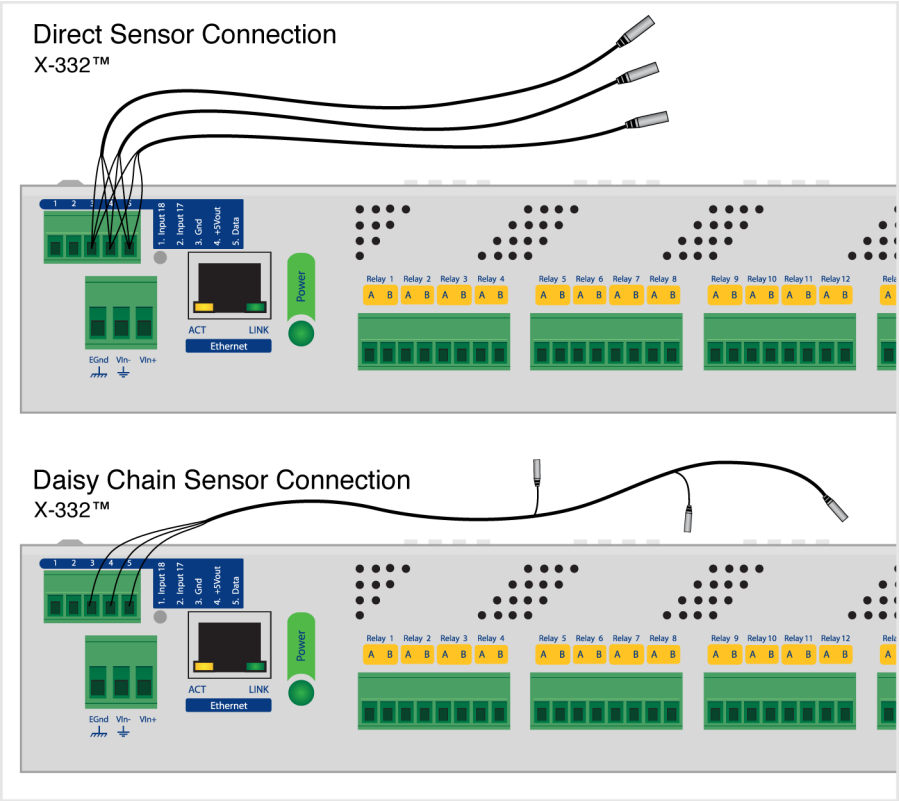


Figure 2.2h- Direct Connection (Star) and Daisy Chain Connection(Linear)

Multiple sensors can be connected in two ways: directly connected to the unit (star topology) or “daisy chained” (linear topology) as shown in Figure 2.2g. Many factors will determine the maximum length of the cable. Some of these factors include, but are not limited to, the type of cable used, the number of sensors, ambient electromagnetic noise, and sensor network topology. Combined cable lengths to all sensors of 600 ft using Cat 5e cable have been successful. However, due to the uniqueness of installation environments, results may vary. Please test in the desired environment before permanent installation.

The following are general recommendations that will maximize sensor runs and minimize problems. Cat 5 and Cat 5e network cable has proven to be an effective and low-cost solution for long runs. Other cable types can be used, but cable capacitance may limit the length. Figure 2.2h shows the recommended connection using Cat 5 network cable. Connect all unused conductors to ground.

Figure 2.2i - Recommended connection using Cat 5 cable

A linear (daisy chain) topology will minimize signal reflections, providing a more reliable connection and will allow longer cable length than a star topology.
Appropriate strain relief should be used at the X-332™ and other connections that may be subjected to vibration, movement, or repeated handling.

- Avoid sensor runs adjacent to industrial equipment power cables. These cables can have the potential for high voltage spikes that may induce noise on the sensor signals. Similarly, avoid running sensor cables near any radio transmission antennas or coaxial feed-lines.
- Protect any electrical connections with appropriate weather shielding.
- Due to the broad range of applications and environments where the X-332™ may be employed, successful installations of long sensor runs may vary significantly.

Two counter inputs (inputs 17 and 18) are provided which can be connected to dry contact sensors or switches. Sensors can be used for monitoring alarm conditions such as access or thresholds. Alternatively, you can also control outlets by connecting switches to these inputs, and configuring them to control the outlets. Each input can also function as a counter *(for configuration see section 2.5.4).*

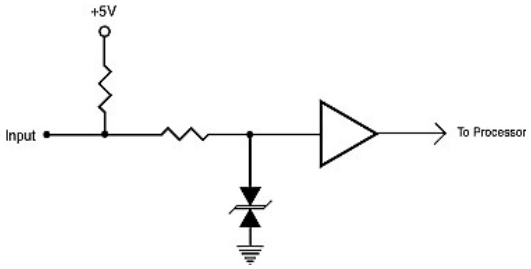


Figure 2.2j- Input Schematic

Connect one terminal of the sensor or switch to the input terminal (Input 17 or Input 18) on X-332™. Connect the other terminal to the ground terminal on X-332™. When contacts are closed the input is connected to ground and the input is considered to be “ON” *(see figure 2.2e).*

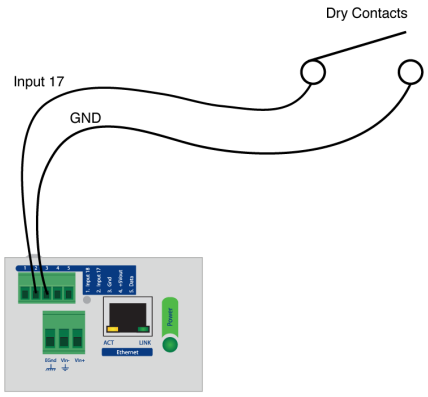


Figure 2.2k - Input Connection

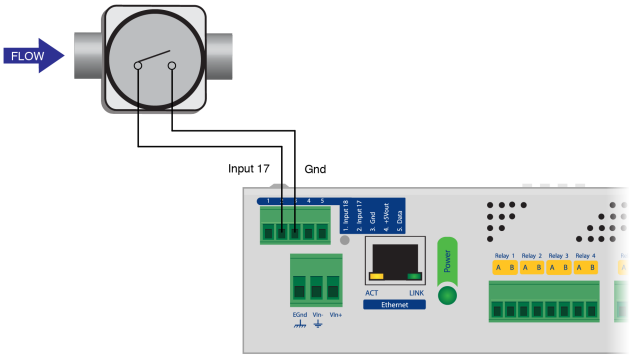
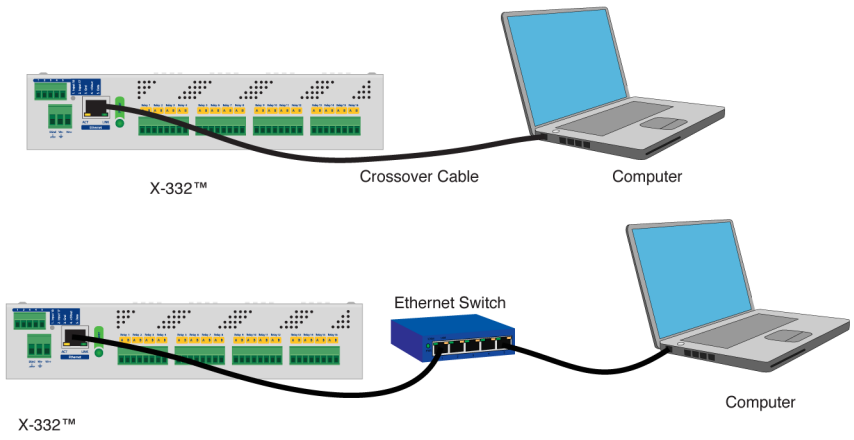


Figure 2.2l - Recommended connection using Cat 5 cable

2.2.5 Network Connection

Figure 2.2m - Network Connection



Connect the Ethernet port to a 10 Base-T, 10/100 Base-T, or 10/100/1000 Base-T Ethernet connection. This typically connects to an Ethernet hub, switch, or router. For configuration, X-332™ may be connected directly to the Ethernet port on a computer using a “crossover” cable. Otherwise, for connection through a hub or router, a standard “straight-through” cable should be used. X-332™ can be used on a wireless network by connecting through an Ethernet bridge or a wireless router.

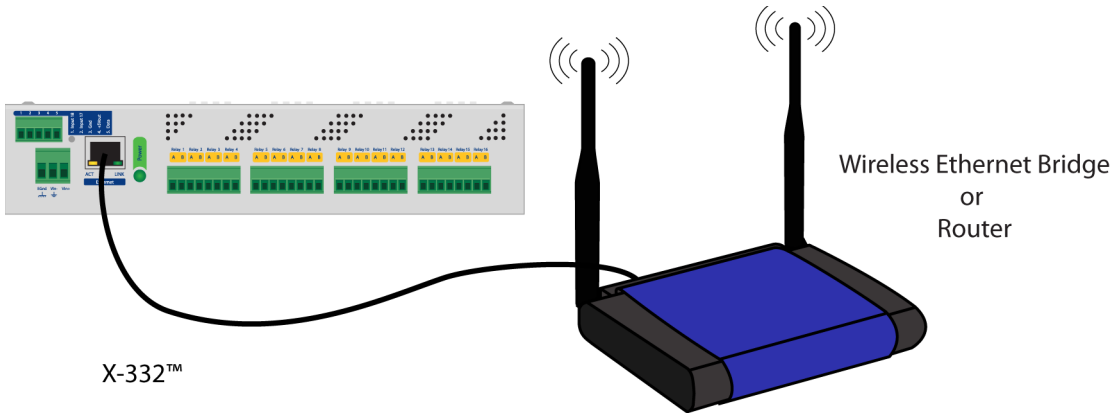


Figure 2.2n - Wireless Connection

Note: The wireless Ethernet bridge or router must be properly configured for the wireless network. Refer to the installation instructions for the wireless device.

2.3 Establishing Communications for Setup

In order to configure the X-332™ on its built-in, web browser interface, the X-332™ and computer must be addressed on the same network. This can be done by one of two methods:

Method 1 – Assign a temporary IP address to the X-332™ to work on an existing network.
-or-
Method 2 – Temporarily change the IP address of a computer connected to the X-332™ to match the network of the default IP address used by the X-332™.
Note: If multiple ControlByWeb™ products are used on the same network, install one at a time and set the IP address of each unit before connecting the next unit to the network. This avoids having multiple devices on the network with the same factory default IP address at the same time. If this approach is used, be sure to clear the arp cache after disconnecting each unit (`arp -d`).

2.3.1 Method 1: Assign a Temporary IP address to X-332™

This option is used to TEMPORARILY assign an IP address to the X-332™ without the need to change the IP address of the configuration computer. The X-332™ will use this IP address as long as power is maintained. Once power is lost, the X-332™ will use the IP address assigned in the setup page and not the temporary address assigned here.

Make sure that the X-332™ and the configuration computer are connected to the same network.

This will not work through routers or gateways.

Microsoft Windows Instructions

1. Open a Command Prompt (select START, then RUN, then type “cmd”).

   Note: For Vista, the Command Prompt should be run as administrator (select Start, then type “cmd” and right click on “cmd” and select “Run as administrator”).
2. Type:

   ```
   arp -s {new IP address} {serial number of X-332™ }
   ```

   Note: IP address format is xxx.xxx.xxx.xxx. The serial number can be found on a label on the module board. The format is ss-ss-ss-ss-ss-ss.
   For example, to set X-332™ (with serial number 00-0C-C8-01-00-01) to 10.10.10.40 the following command would be used:

   ```
   arp -s 10.10.10.40 00-0c-c8-01-00-01
   ```
3. Next, type:

   ```
   ping -l 102 {new IP address}
   ```

   For example, if the new IP address is 10.10.10.40, the following command would be used:

   ```
   ping -l 102 10.10.10.40
   ```
4. Proceed with X-332™ setup in section 2.4.

   Once setup is complete, it may be necessary to clear the 'arp' cache to configure additional WebRelays. This is necessary because each unit has the same default IP address, but a different unit serial number (MAC address). Clearing the arp table can be done by typing `arp -d` in the command prompt window.

Linux/Unix Instructions

1. Open a terminal and change to root user (su -, then enter root password).
2. Type:

   ```
   arp -s {new IP address} {serial number of X-332™ }
   ```

   Note: IP address format is xxx.xxx.xxx.xxx. The serial number can be found on a label on the module board. The format is ss:ss:ss:ss:ss:ss.
   For example, to set X-332™ (with serial number 00-0C-C8-01-00-01) to 10.10.10.40 the following command would be used:

   ```
   arp -s 10.10.10.40 00:0c:c8:01:00:01
   ```

3. Next, type:

   ```
   ping -s 102 {new IP address}
   ```

   For example, if the new IP address is 10.10.10.40, the following command would be used:

   ```
   ping -s 102 10.10.10.40
   ```

4. Proceed with X-332™ setup in section 2.4.

   Once setup is complete, it may be necessary to clear the 'arp' cache to configure additional WebRelays. This is necessary because each unit has the same default IP address, but a different unit serial number (MAC address). Clearing the arp table can be done by typing `sudo arp -d -a` in the command prompt window.

Mac OS X Instructions

1. Open a terminal.

   Note: The terminal is in the "Utilities" directory, which is in the "Applications" directory.
2. Type:

   ```
   sudo arp -s {new IP address} {serial number of X-332™ }
   ```

   Administrator password may be required.

   Note: IP address format is xxx.xxx.xxx.xxx. The serial number can be found on the label on the module board. The format is ss:ss:ss:ss:ss:ss.
   For example, to set a X-332™ (with serial number 00-0C-C8-01-00-01) to 10.10.10.40 the following command would be used:

   ```
   sudo arp -s 10.10.10.40 00:0c:c8:01:00:01
   ```

3. Next, type:

   ```
   ping -s 102 {new IP address}
   ```

   For example, if the new IP address is 10.10.10.40, the following command would be used:

   ```
   ping -s 102 10.10.10.40
   ```

4. Proceed with X-332™ setup in section 2.4.

Once setup is complete, it may be necessary to clear the 'arp' cache to configure additional WebRelays. This is necessary because each unit has the same default IP address, but a different unit serial number (MAC address). Clearing the arp table can be done by typing `sudo arp -d -a` in the command prompt window.

2.3.2 Method 2: Assign a Temporary IP Address to the Configuration Computer

If the first option above is not used, you can use this option to communicate with the X-332™. By default, X-332™ comes from the factory with an IP address of 192.168.1.2. Communication with the X-332™ may be established by assigning an IP address to the configuration computer such that it is on the same network as X-332™ (for example, the configuration computer could be assigned to 192.168.1.50)

The following example is for those running the Windows operating system:

1. Window Vista/7 – Select the Windows Icon (Start Menu) and enter `ncpa.cpl` into the search bar and press Enter (Figure 2.3a).

   Windows XP – Open the control panel by clicking on the start menu and then on Control Panel.

   Note: The control panel shown (Figure 2.3b) is in "Classic View." If the control panel is in "Category View," select the "Classic View" option before proceeding.

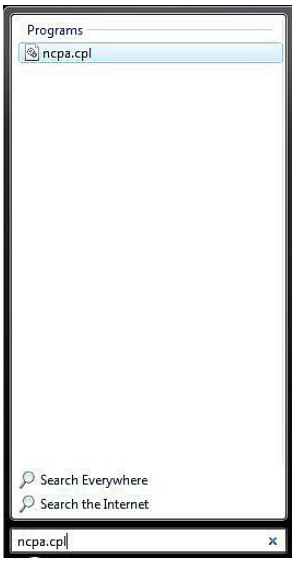


Figure 2.3a- Vista/7 Start Menu

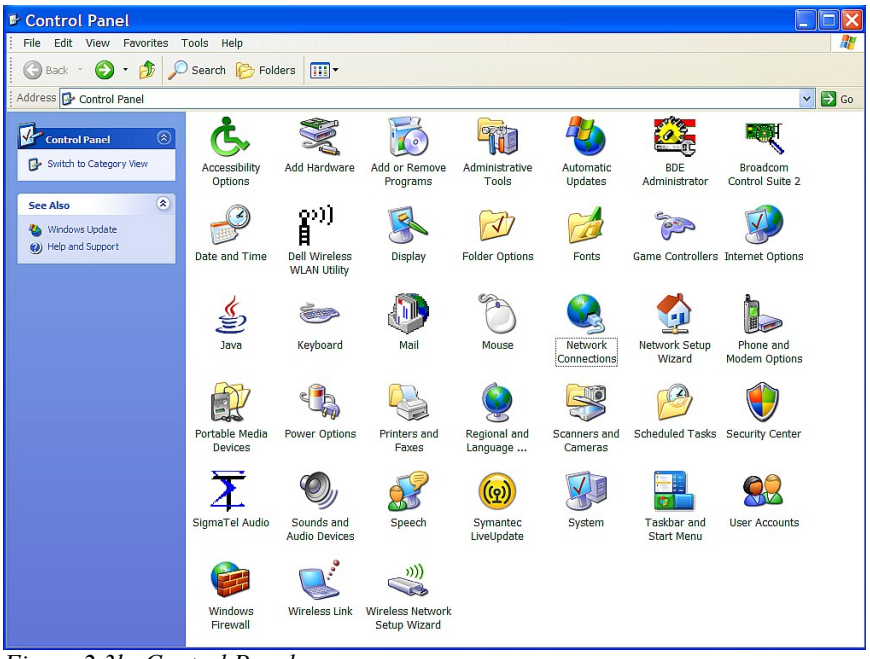


Figure 2.3b- Control Panel

2. Double click on the icon labeled Network Connections. The Network Connections window will open (Figure 2.3b).

3. Right click on the icon labeled *Local Area Connection*. In the menu that follows, select the option at the bottom of the menu labeled *Properties*. The Local Area Connection Properties window will appear (Figure 2.3c).

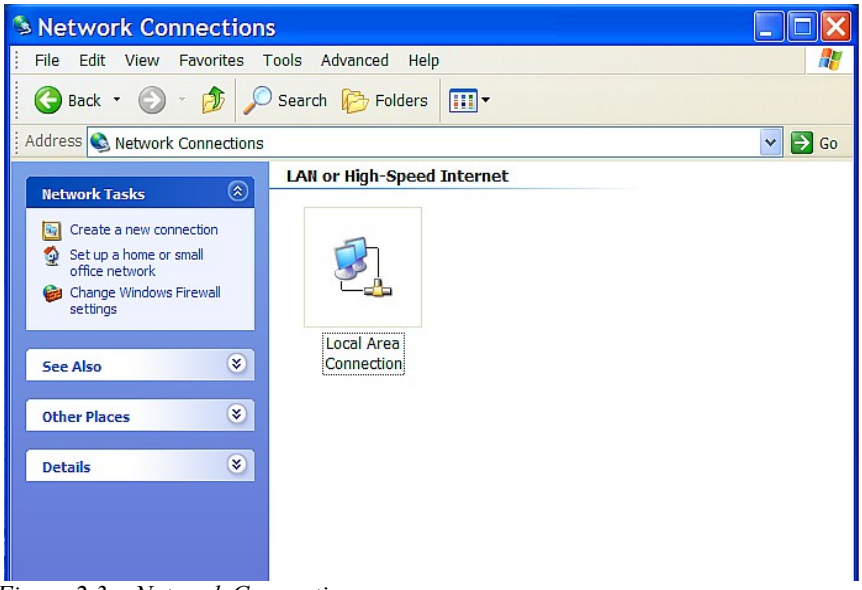


Figure 2.3c- Network Connection

4. In the Local Area Connection Properties window in the Connection Uses box, scroll down and highlight "Internet Protocol (TCP/IP)." Click the button labeled "Properties." The "Internet Protocol (TCP/IP)" Properties menu appears (Figure 2.3e).

   Note: If "Use the following IP address" is already selected, the computer has been setup with a static IP address. Record these values so that the IP address of the computer can be restored once the IP address of the X-332™ has been successfully changed.

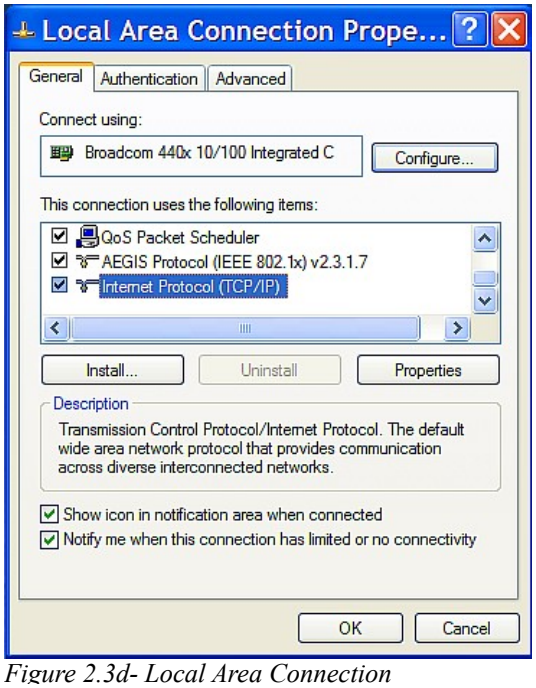


Figure 2.3d- Local Area Connection

5. Select the radio button labeled "Use the following IP address" and type in the IP address:

   `192.168.1.50`

6. Type in the subnet mask:

   `255.255.255.0`

   No need to change the default gateway or DNS fields. Click OK to accept the new settings.

7. Open the setup pages as described in section 2.4. If the setup pages are not accessible, verify that X-332™ is powered on and that the LINK light is illuminated. Check all network connections and settings.

   Another way to check communications is to ping X-332™ from the command prompt by typing `ping {X-332™ IP address}`.

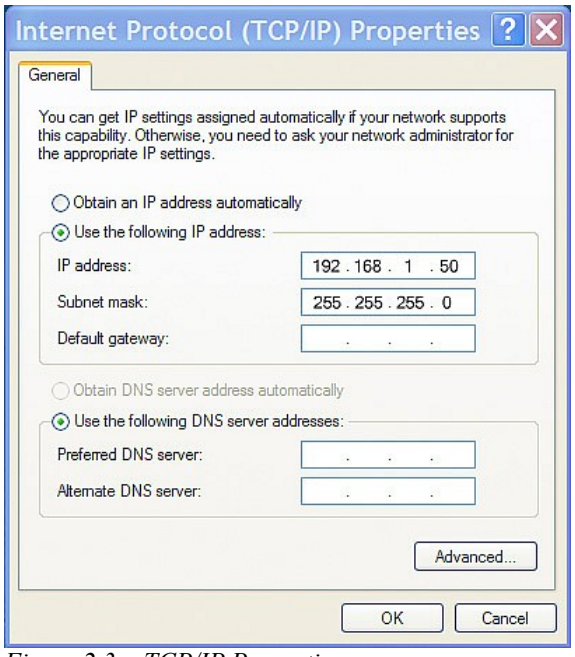

Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
192 . 168 . 1 . 50
Subnet mask:
255 . 255 . 255 . 0
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

Figure 2.3e- TCP/IP Properties

2.4 X-332™ General Settings Setup Pages

X-332™ is configured using a web browser. To access the setup pages, enter the following URL in the address bar of a web browser:

`http://{ipaddress}/setup.html`

For example, using the default IP address, enter:

`http://192.168.1.2/setup.html`

The setup pages are divided into two sections: General Settings and I/O Setup. A third section is for monitoring and controlling the device.

Before any setup page submission, the browser will request a username and password. The default username is `admin` and the default password is `webrelay` (password is case sensitive).

To access the general settings setup pages choose *General Settings* on the menu bar on the left side of the setup screen.

Figure 2.4a - Main Tab

2.4.1 Information Tab

This is the initial page that is displayed when setup.html is entered into the address bar of the browser. It displays the part number, firmware revision, and serial number of the unit. It also allows the user to select the desired temperature units.

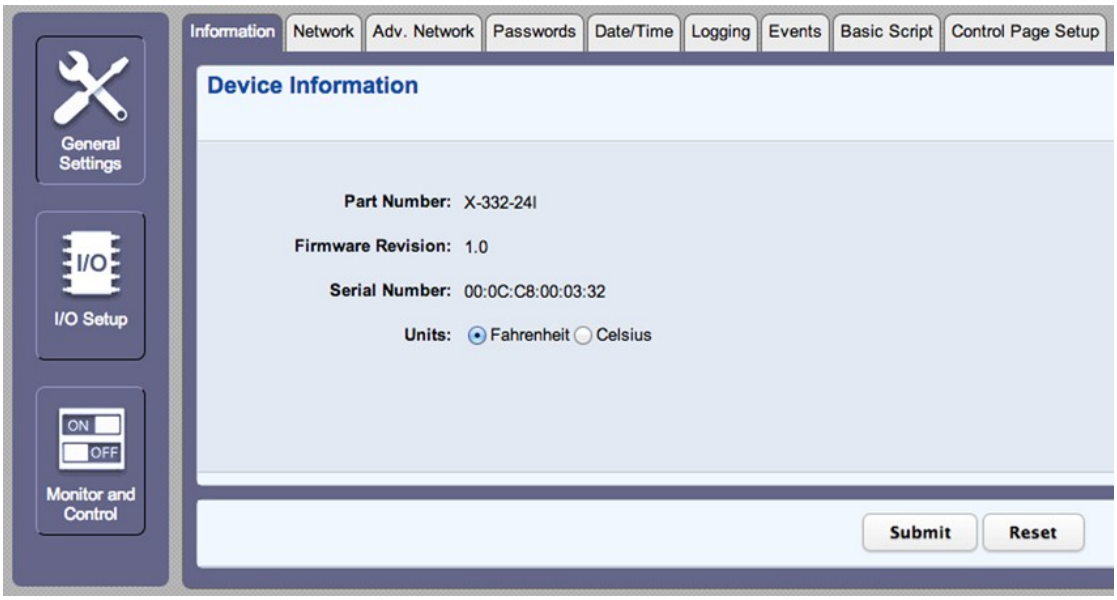


Figure 2.4b- Information Tab

Units

This allows the user to select between the temperature units of ***Fahrenheit*** and ***Celsius***. All settings entered and displayed on subsequent pages will be in the units selected.

Part Number

This displays the full model number of X-332™.

Firmware Revision

This is the current product revision of the unit's firmware.

Serial Number

This is the serial number of this unit. The serial number is also the MAC address of the unit.

2.4.2 Network Tab

The network parameters are set on this page.

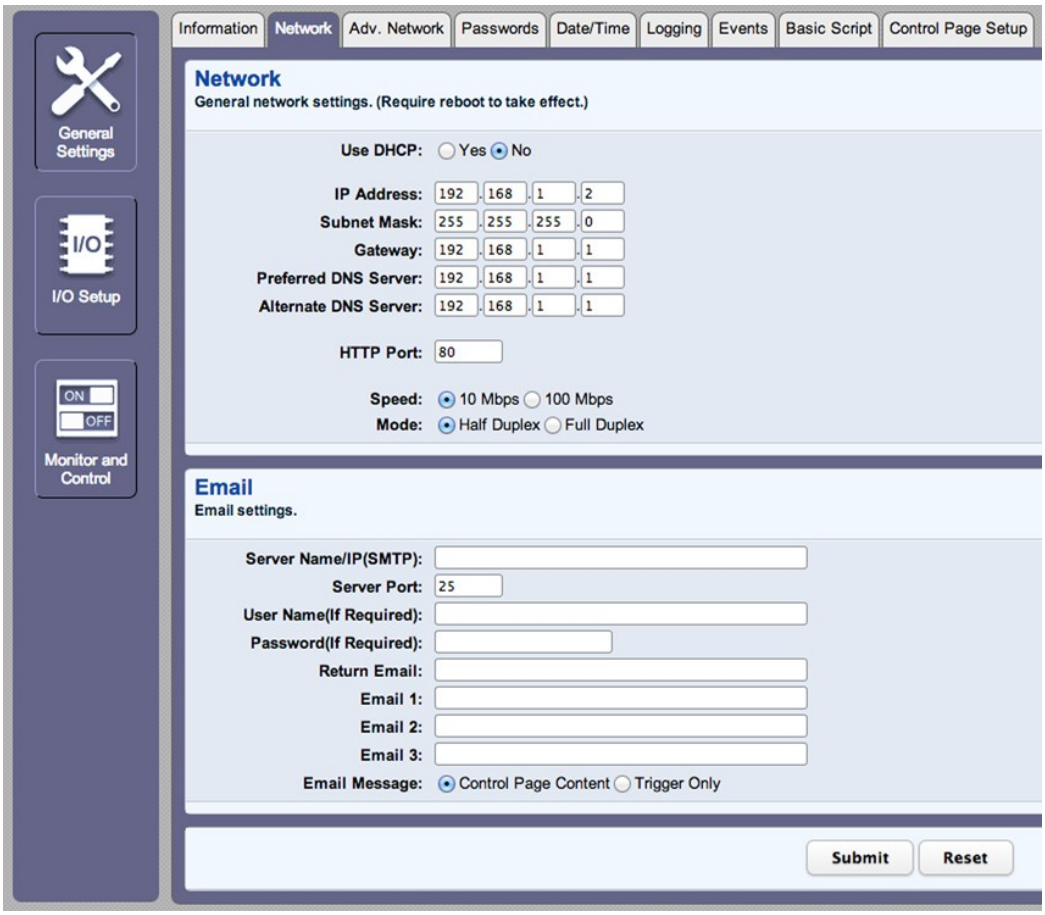


Figure 2.4c - Network Tab

Note: X-332™ must be power-cycled (power disconnected, then reconnected) before network settings take effect. Only the settings on the **Network** tab require power-cycling before taking effect.

Use DHCP

This option allows DHCP to be enabled or disabled. If this option is set to ***Yes***, X-332™ will wait for an IP address from a DHCP server each time it is powered. The default setting is ***No*** (this is recommended for most installations). To use DHCP, click the **Yes** radio button, then press submit. Once this is complete, power cycle the X-332™ – Once restarted, the IP address will be assigned. When the X-332™ is assigned an IP address using DHCP, the new IP address can be found through the list of clients kept by the DHCP server. For most instances, the DHCP server is in the local gateway or router.

Brief Notes About DHCP

All devices on an IP network require an IP address. This is a unique address that identifies each device on the network. DHCP (Dynamic Host Control Protocol) is a mechanism that automatically assigns an IP address to a computer (or other devices) when it is connected to a network. This eliminates the need to manually enter the IP address. When a computer is connected to the network, another device on the network called a DHCP server detects the presence of the computer and dynamically assigns the IP address to that computer. On many small networks, the DHCP server is built into the router.
DHCP works well for "client" devices such as computers, but is not ideal for servers. This is because servers usually don't initiate communications with other devices, but rather they wait for a request from "clients." To make this request, the client must know the IP address of the server. If a server gets its IP address dynamically, the IP address may not always be the same so client devices may not be able to find the server. For this reason, servers usually use an IP address that is fixed and does not change. X-332™ is a server and manual IP address assignment is usually recommended.

IP Address

Enter the IP address for X-332™ in this field. The IP address is specific to the network where X-332™ will be installed, and must be obtained from the network administrator. For more information on IP addresses and remotely accessing X-332™ over the Internet, see **Appendix C: Accessing X-332™ Remotely Over the Internet**. The default setting for this field is 192.168.1.2.

Subnet Mask

The subnet mask defines the size of the local network. This can be obtained from the network administrator. For additional information about sub-netting and IP networking, many tutorials are available on the Internet. The default setting for this field is 255.255.255.0.

Gateway

This specifies the IP address of the gateway router. This can be obtained from the network administrator. The default setting for this field is 192.168.1.1.

Preferred DNS Server

The IP address of the Primary DNS server is specified here. When DNS services are required, this is the address that will be used. The default setting for this field is 192.168.1.1.
This field is only required when the following options are used:

- **Remote Services** (when server is specified by name and not IP address).
- **Sync time clock with remote NTP server** (when server name is specified by name and not IP address).
- **Mail Server** (when server name is specified by name and not IP address).

Alternate DNS Server

This field is used to specify the IP address of a Secondary DNS server. This is used when X-332™ requires DNS services and the preferred DNS server is not available. The default setting for this field is 192.168.1.1.

HTTP Port

The TCP port used for HTTP communications (web browser, xml, get commands) with X-332™ is specified here. The default setting for this field is 80, which is the standard HTTP port. It is recommended that the port be left unchanged unless the user has an understanding of TCP/IP and ports. For more information on TCP ports and IP addressing see **Appendix C: Accessing X-332™ Remotely Over the Internet**.

Speed

This option sets the data rate (clock rate) of the Ethernet port. Either ***10 Mbps*** or ***100 Mbps*** can be selected. The ***100 Mbps*** option offers faster communications but the amount of data to and from X-332™ is so small that users will not likely notice much (if any) difference. When the X-332™ is set to ***10 Mbps***, it draws less power and runs a little cooler, which may translate into a longer product life. The default setting for this field is ***10 Mbps***.
IT IS RECOMMENDED THAT THIS SETTING BE LEFT AT **10 Mbps** UNLESS THE USER HAS A SPECIFIC REASON TO USE **100 Mbps.**

Mode

This option allows the Ethernet port to be set to ***Half Duplex*** or ***Full Duplex***. Legacy Ethernet operates in ***Half Duplex*** mode which means that devices can either send data or receive data, but not both at the same time. ***Full Duplex*** means that devices can send and receive data at the same time. The default setting for this field is ***Half Duplex***.

Email Server Name/IP (SMTP)

The name of the SMTP (Simple Mail Transfer Protocol) mail server (for example mail.example.com) or the IP address of the mail server (for example 192.10.10.10) should be entered in this field. There is no default setting for this field.
Note: If the server name is entered and not the IP address, the address of a DNS server will be required in the DNS field.

Email Server Port

This field is used to specify the SMTP Mail Server Port. The default setting is 25, which is the standard SMTP port.

User Name (If Required)

If the SMTP mail server requires authentication, the user name must be entered here (40 character limit). There is no default setting for this field.

Password (If Required)

If the SMTP mail server requires authentication, the password must be entered here. There is no default setting for this field.

Return Email

X-332™ will not receive email messages, but when X-332™ sends email messages, it must include a return email address. This field is used to specify the return email address. Note that although X-332™ will send email messages with any email address specified in this field, some email filters (spam filters) will not allow messages through that include an invalid email address. There is no default setting for this field.

Email 1 to Email 3

Enter the email addresses of up to three recipients for alarm messages in these fields. There are no default settings for these fields.

Email Message

Choose either “Control Page Content” or “Trigger Only” email formats. When “Control Page Content” is selected, all visible fields in the control page will be included in the email message to be sent out; however if “Trigger Only” is selected, the email content will only be a brief description of what triggered the email message.

Testing Email Functionality

Once the email settings are entered, the email functionality can be tested by entering the following command: `http://IP address/state.xml?testEmail=1`

For example, using the default IP address, enter:
`http://192.168.1.2/state.xml?testEmail=1`

This will cause an email message to be sent immediately. If the messages don't get through, the system log file may have some clues to assist in diagnosing the problem (http://192.168.1.2/syslog.txt). See **Appendix D: Log Files** for additional Logging Information.

Remote Reboot

To cause the device to reboot, the following command can be entered into the address bar of the browser: http://192.168.1.2/networkSetup.srv?rbt=1 The username and password will be requested before the reboot will occur, so that only administrators of the device can cause the reboot.

MTU Setting

To change the MTU, manually enter the advSetup.html (case sensitive) page into the address bar. (http://192.168.1.2/advSetup.html). This new setup page will have a text box that will allow the MTU to be changed. The valid range is 256 to 1476 bytes. MTU is a network parameter that stands for Maximum Transmission Unit. This defines the max size, in bytes, of the TCP packets sent out from the device. This normally can be left alone, but there are some circumstances where it might be beneficial to change it. One of these circumstances is when the device is to be used over a VPN (virtual private network). VPN's add extra information to TCP packets, if the new packets are too big to physically travel across the network (greater than about 1500 bytes) then the packets will be split up. This causes problems for some firewalls and those firewalls will just discard the packets. To fix this, the MTU can be adjusted until the TCP packets do not get split up.

2.4.3 Adv. Network Tab

Note: These settings are not used for most installations.

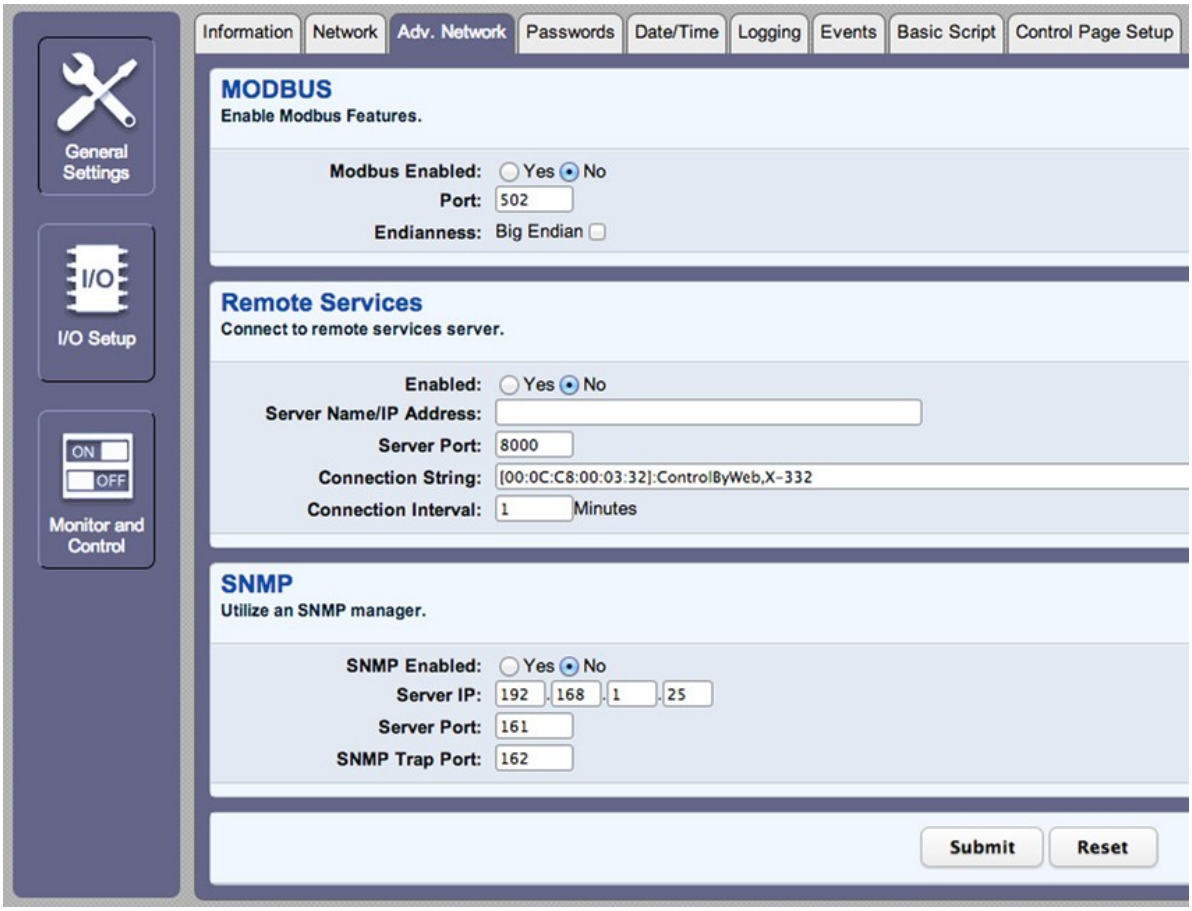


Figure 2.4d - Advanced Network Tab

Modbus Enabled

X-332™ can support Modbus/TCP. Modbus is a messaging structure protocol used in industrial manufacturing control and automation. It is an open protocol and offers interoperability with software and devices from other manufacturers. This is enabled by selecting ***Yes*** in this field. The default setting for this field is ***No.*** (See **3.4 Modbus Operation** for more information on using X-332™ on a Modbus network.)
Note: Modbus communications are disabled whenever the Control Password is enabled.

Modbus Port

This specifies the port used for Modbus/TCP communications with X-332™. By default this is set to port 502 which is the standard Modbus port. It can be set within the range of 0 to 65535.

Endianness

32-bit data is treated as two individual 16-bit words using IEEE 754 floating point format. Floating point format is used for sensor, pulse counter, and analog data as well as for setting output pulse duration.
If the checkbox is set, the X-332™ will use big-endian architecture, and the most significant 16-bit word (big end) is sent first. If the box is cleared, then the X-332™ will use little-endian architecture, and the least significant word (little end) is sent first. The default setting for this box is ***unchecked,*** use little-endian.
For example, in little-endian format, a 32-bit floating point number represented by '1234 ABCD' is sent as 'ABCD 1234'.

Remote Services Enabled

This option enables or disables Remote Services. If ***Yes*** is selected, Remote Services will be enabled as soon as the submit button is pressed and X-332™ will immediately attempt to make a connection with the remote server (power cycle not required). Once a connection is established, the connection will remain until it is disconnected by the remote server. Proper connection with the remote server can be verified by viewing the system status log file (see **Appendix D: Log Files**). The default setting for this field is ***No***. Most users should leave this setting at its default. (See **Remote Services** at the end of this section for more information.)

Server Name/IP Address

Specify the name or IP address of the Remote Services server here. If the IP address is specified, enter it in this format aaa.bbb.ccc.ddd. For numbers that are less than 100, preceding zeros should not be included (for example, enter 80 rather than 080). This field can be up to 40 characters long and has no default setting.

Server Port

Enter the TCP port used for the Remote Services server. This can be set within the range of 0-65535. The default setting for this field is 8000.

Connection String

This text is sent to the Remote Services server when the connection is established. This string should include any information required by the server at connection. For example, it may include an ID number, customer number, password, etc. The format is entirely dependent upon the server requirements. This field can be up to 80 characters long. Default text is provided only as an example placeholder. The default text is [<`Serial Number`>]:ControlByWeb,X-332.

Connection Interval

This field specifies the periodic interval in which X-332™ attempts to connect to the remote server, or if X-332™ is already connected, it is the interval in which X-332™ sends the connection string. This field can be set within the range of 1 to 34452 minutes. The default setting for this field is 1 minute.

SNMP Enabled

When this option is set to ***Yes***, X-332™ will support SNMP. The default setting for this option is ***No***. (See **SNMP** at the end of this section for more information.)

SNMP Server IP

When SNMP is used, this field is used to specify the IP address of the SNMP manager. The default setting for this field is 192.168.1.25.

SNMP Server Port

When SNMP is used, this field is used to specify the SNMP port that X-332™ listens on. The default setting for this field is 161.

SNMP Trap Port

When SNMP is used, this field is used to specify the SNMP Trap port of the SNMP manager. The default setting for this field is 162.

Remote Services

Remote Services initiates an outgoing connection to a server at a remote location. This can be used in an environment where a web server on the Internet provides a custom web page to X-332™ and other ControlByWeb products. Users access X-332™ through the web server rather than communicating directly with it. This method is sometimes referred to as “web services” and allows programmers to create powerful, custom web pages to multiple devices using the web programming languages of their choice.
Remote Services initiates the connection to the external web server (rather than the web server initiating communications to X-332™). This has two main benefits. First, the web server does not need to know the IP address of X-332™. This means that X-332™ can get its IP address dynamically from a DHCP server, simplifying the installation. Second, since the connection from X-332™ is outgoing, rather than incoming, the local router on the network where X-332™ resides doesn't need to be configured to forward sockets. This also simplifies the installation. Since the router configuration is not modified, the risk of compromising security on the local network is eliminated. For more information about the **Remote Services see Appendix E: External Server and Remote Services**.

SNMP

Simple Network Management Protocol (SNMP) is used to manage and administer network devices. X-332™ supports SNMP V1.0 and can be configured here. Using SNMP, the I/O states of X-332™ can be read as well as some basic information about the device. See **Appendix F: SNMP Requests** for information about how to request information from X-332™ using an SNMP manager, as well as where to find MIB files for X-332™.
Note: The read and write community strings used for SNMP are actually the Control Password found on the Password setup tab (see Section 2.4.4). If the Control Password is disabled, then X-332™ does not check for the community string when issued a Get or GetNext request from the SNMP manager.

2.4.4 Password Tab

X-332™ requires a password to log into the setup pages. The password can be changed on this page. Additionally, a password can be enabled for the **Control Page**.

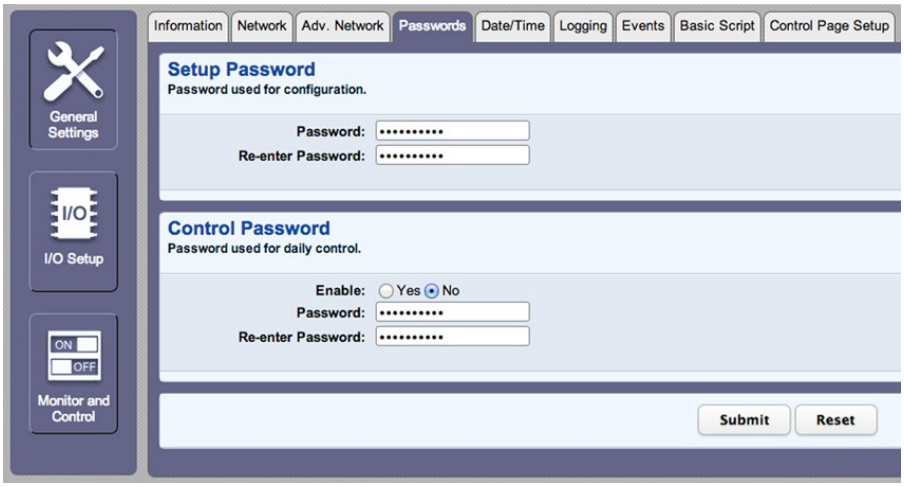


Figure 2.4e - Password Tab

Setup Password

The Setup Password, which is required to access the setup pages, can be modified by entering a new password here. Passwords that are 8 characters or longer (13 characters max) with both alphabetic and numeric characters are recommended (A-Z, 0-9). For security purposes, the password will not be displayed as it is entered. Note: the username required for accessing the setup pages is `admin` (all lower case). The default Setup Password is `webrelay` (all lower case).

Re-enter Setup Password

When the Setup Password is changed, it must be entered twice - one time in the previous field and a second time in this field. If the password is not entered identically in both fields, the password will not be changed.

Enable Control Password

The **Control Page** can be viewed without entering a password. For security purposes, a password can be set to access the **Control Page**. When this field is set to ***Yes***, a password will be required to view the **Control Page**. The default setting for this field is ***No***. *Note: Since Modbus has no provision for passing passwords, the* ***Control Page*** *password will not take effect if Modbus is enabled.*

Control Password

When the Enable Control Password option above is set to ***Yes***, this field is used to specify the password which will be required to access the **Control Page**. Passwords that are 8 characters or longer with both alphabetic and numeric characters are recommended. (A-Z, 0-9). For security purposes, the password will not be displayed as it is entered. Note: X-332™ requires a password, but does not require a user name to access the **Control Page**. However, some browsers require a user name. In this instance enter `none` as the user name. The default Control Password is `webrelay`.

Re-enter Control Password

When the Control Password is changed, it must be entered twice- one time in the previous field, and a second time in this field. If the password is not entered identically in both fields, the password will not be changed.

2.4.5 Date/Time Tab

X-332™ uses the time of day for scheduled events, such as turning the Outputs ***ON*** or ***OFF*** at scheduled times and for logging (a time stamp is included with each logged event). The time is stored and displayed in 24-hour time format. X-332™ has a capacitor-backed real-time-clock circuit that will keep track of time for several days in the event of a power failure.

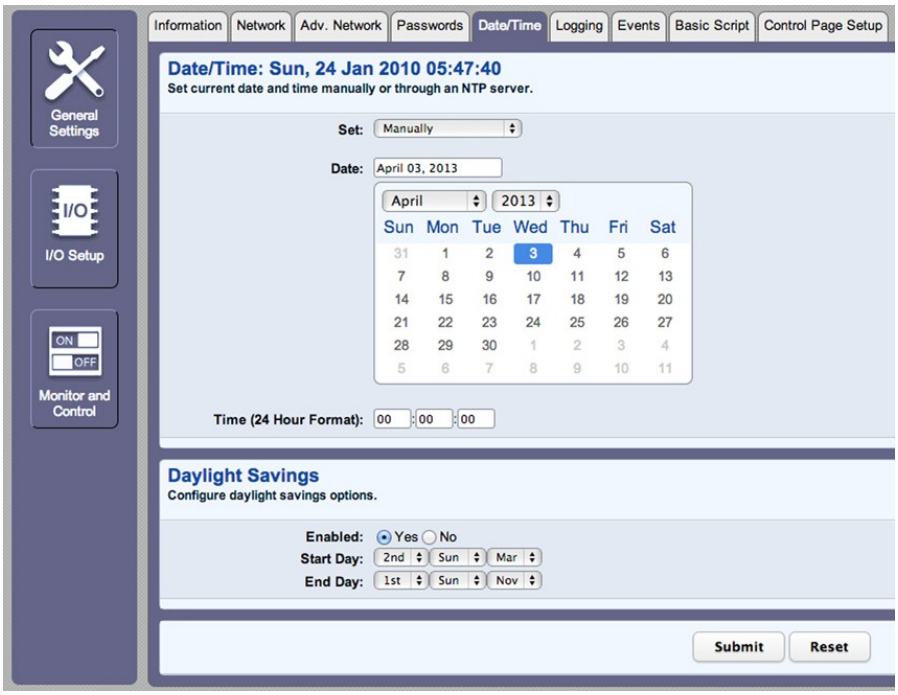


Figure 2.4f - Date/Time Tab - Set Time Manually

Date/Time

This is the current date and time stored in X-332™. The time is stored and displayed in 24-hour format.

Set Time

This drop-down list offers two options for setting the time: ***Manually*** or ***Sync with NTP server***. The options that follow this field will change based upon how this option is set.

- ***Manually*** requires the user to enter the time and date.
- ***Sync with NTP server*** allows the user to set the clock automatically by using an NTP (Network Time Protocol) server.

Manual Time Configuration

Date

The current date is entered by first selecting the correct month and year,using the left and right arrows at the top of the calender. The single arrows(< and >) change the month and the double arrows (<< and >>) change the year. Once the current month and year are displayed, select the correct day, which will then be highlighted.

Time (24 Hour Format)

Enter the time as HH:MM:SS. (HH represents hours in 24-hour format [00-23], MM represents minutes [00-59], SS represents seconds [00-59].)

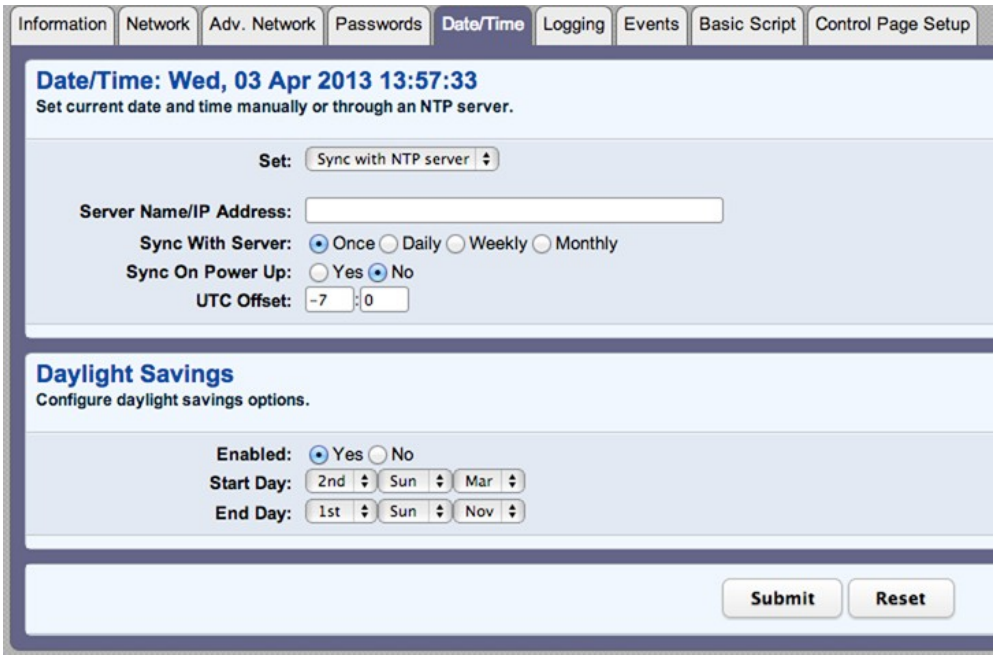


Figure 2.4g - Date/Time Tab - Sync with NTP Server

NTP Time Configuration

Server Name/IP Address

This field is used to specify the name or IP address of the NTP server. If a name is specified, a working DNS server address must be entered into the Network settings. If the IP address is specified, it should be entered in the following format aaa.bbb.ccc.ddd where each of the letters represents a number between 0 and 255. This field can be up to 40 characters. There is no default value for this field.

Many NTP Internet servers are available. In addition, many desktop computers will function as an NTP server (both Mac and PC). If a desktop computer is used, firewall settings may need to be adjusted to allow for NTP communications on port 123.

Public NTP servers can be found at www.pool.ntp.org. Some of these are listed below.

US Servers (http://www.pool.ntp.org/zone/us):
0.us.pool.ntp.org
1.us.pool.ntp.org
2.us.pool.ntp.org
3.us.pool.ntp.org

North America (http://www.pool.ntp.org/zone/north-america):
0.north-america.pool.ntp.org
1.north-america.pool.ntp.org
2.north-america.pool.ntp.org
3.north-america.pool.ntp.org

Europe (http://www.pool.ntp.org/zone/europe):
0.europe.pool.ntp.org
1.europe.pool.ntp.org
2.europe.pool.ntp.org
3.europe.pool.ntp.org

Australia (http://www.pool.ntp.org/zone/au):
0.au.pool.ntp.org
1.au.pool.ntp.org
2.au.pool.ntp.org
3.au.pool.ntp.org

South America (http://www.pool.ntp.org/zone/south-america):
0.south-america.pool.ntp.org
1.south-america.pool.ntp.org
2.south-america.pool.ntp.org
3.south-america.pool.ntp.org

Africa (http://www.pool.ntp.org/zone/africa):
1.africa.pool.ntp.org
1.pool.ntp.org
3.pool.ntp.org

Sync With Server

This option allows the user to specify how often the time on X-332™ will be synchronized with the time server. When the submit button on this page is pressed, X-332™ will immediately synchronize with the time server. If Daily, Weekly, or Monthly options are selected, X-332™ will thereafter re-synchronize with the time server at the period interval specified starting at 12:00 AM (00:00).
The exact time the NTP Request occurs is 12:00 AM (00:00) plus the minute equivalent of the last two digits in the models serial number. For example, if the last two digits in the model's serial number were -09, the NTP Request will occur 9 minutes after 12:00 AM. The default value of this setting is Once (the unit will immediately sync with the NTP server, but will not automatically sync again).

Sync on Power Up

When this option is set to ***Yes,*** X-332™ will be synchronized with the time server each time it is powered.
Note: If X-332™ will lose power on a frequent basis, it may be beneficial to set this option to ***No****; some servers are configured to dis-allow access from client devices that excessively request their services. The default value of this setting is* ***No.***

UTC Offset

Time servers return the current time in Universal Time (GMT). It is common for many servers and data loggers to use GMT as their official time, even when they are not located within the GMT time zone. The default value for this field is -7 (Mountain Standard Time). For convenience, the time can be converted to local standard time by entering the offset here. This manual cannot include the UTC Offset for all parts of the world, but the offset for GMT time and the four major US Time zones are listed here.

GMT Time: 0
Eastern Standard Time: -5
Central Standard Time: -6
Mountain Standard Time: -7
Pacific Standard Time: -8

Daylight Savings

In many parts of the United States and in some other countries, the time is shifted forward by one hour during the summer months. This is an effort to conserve energy by making the daylight last longer into the evening hours. If this option is set to ***Yes***, the time on X-332™ will automatically be shifted forward by one hour between the hours of 12:00 AM – 5:00 PM on the Daylight Savings Start date set below, and it will shift back to standard time between the hours of 12:00 AM – 5:00 PM on the Daylight Savings End date set below. The time change is made at a random time within the previously mentioned, five-hour time frame, in order to prevent several different devices from simultaneously requesting a time and overwhelming the NTP server. The default setting is ***Yes.***

Note: Enabling the daylight savings time adjustment, scheduled events will be adjusted for the new time. Logged data includes a time stamp based upon the current time in the device, so it is possible to duplicate log times in the spring and miss log times in the fall. To avoid confusion, many servers and data loggers are set to remain on GMT time and do not shift for daylight savings.

Daylight Savings Start Day

This is the date that daylight savings will start. Note that on this date, between the hours of 12:00 AM – 5:00 PM, the current time will be shifted forward by one hour (i.e. The time will jump from 12:02 AM [00:02] to 1:02 AM [01:02]). By default this is set to the 2nd Sunday in March which is the date used in the United States.

Daylight Savings End Day

This is the date that daylight savings will end. On this date, between the hours of 12:00 AM – 5:00 PM, the current time will be shifted backward by one hour (i.e. The time will jump from 12:02 AM [00:02] to 11:02 PM [23:02] the day before). By default this is set to the 1st Sunday in November which is the date used in the U.S.

2.4.6 Logging Tab

X-332™ can be configured to record data such as changes in I/O state, sensor data, and events. Both periodic and event-based logging are supported. The logged data is stored in internal nonvolatile memory and can be retrieved by entering the URL, http://{X-332 IP address}/log.txt. For more information on logging, see **Appendix D: Log Files**.

The log is stored in non-volatile, flash memory using a circular buffer (old date is over written). 512 kB of memory space is reserved for logging. Log entries are composed of the following components, 14-byte header, and 4 bytes for each log feature selected, except relays and inputs, which add eight bytes regardless of how many are logged. A log of Ain1 (4 bytes) and 4 digital inputs will occupy 26 bytes per entry.

Note: Changing the log settings will erase the current log file.

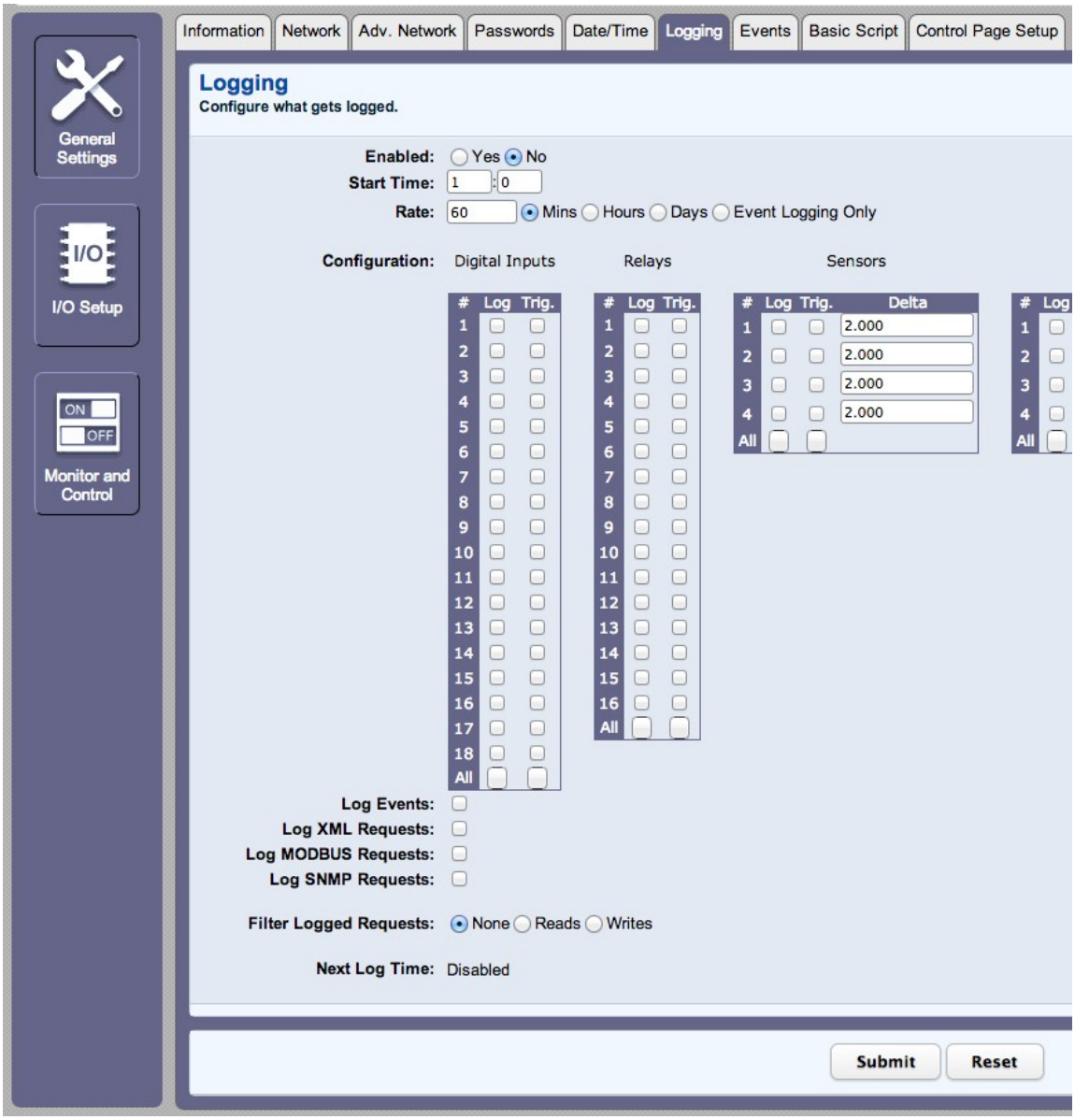


Figure 2.4h - Logging Tab

Logging Enabled

When this option is set to ***Yes***, X-332™ will record data as configured on this page. The default setting for this option is ***No***.
Note: This option controls data logging, but not system logging. System logging is always enabled.
Note: Logging of the Pulse Counter 1 or 2 will reduce the maximum counter rate to 10 Hz. Enabling other options can lower this rate even more.

Start Time

If a logging interval is specified (periodic logging rather than event logging), logging will occur relative to this start time. For example, if the start time is 01:00 and the logging rate is 6 hours, logging will occur at 01:00, 07:00, 13:00, and 19:00. Start time is specified in 24-hour time format. The default setting for this field is 01:00.

Rate

This field is used to specify the time period of logging. A numerical value is entered into the text field, and the unit of time is selected using the adjacent radio buttons. The range of values in this field is 1-20864. Time units are **Minutes**, **Hours**, and **Days**. Periodic logging can be disabled by selecting the Event Logging Only radio button.

Configuration

This section is used to select which inputs, relays, pulse counters, sensors, analog inputs and events get logged and which events trigger the logging. There are five configuration tables. The first column in each table identifies the elements to be logged . The second column is used to specify which events can cause a log entry to be created. The last column is used to specify the Trigger Delta for the corresponding counters and sensors.

When relays are selected as an ***Event Trigger***, logging will occur whenever the selected relays turned ***ON*** or ***OFF***. When inputs are selected as an ***Event Trigger***, logging will occur whenever the input state changes. When pulse counters, sensors and analog inputs are selected as an ***Event Trigger***, logging will occur whenever the input or sensor changes by the trigger delta.
The following ***Log/Event Trigger*** options are available:

- Inputs (1-18)
- Relays (1-16)
- Sensors (1-4)
- Pulse Counters (1-2)
- Analog Inputs (1-4)
- Events
- XML Requests
- MODBUS Requests
- SNMP Requests

Note: Logging activity will lower the highest possible pulse counter rates.

Sensor Trigger Delta

X-332™ can be configured to log data when the count, analog input, temperature, or humidity measured by a sensor changes by the amount specified in this field. This can be set from 1.0 to 9999 units, in 0.1 increments. The default setting for these fields is shown below.

Sensor	Trigger Delta
Counters	2
Analog Inputs	2.0 V
Temperature	2º
Humidity	2%

Filter Logged Requests

When logging is enabled for XML Requests, Modbus Requests, or SNMP Requests, the user can filter out **Reads** (such as reading the Digital I/O states via an XML request) or **Writes** (such as changing the output state via an XML command).

On the **Control Page Setup** tab, the user can specify the refresh rate of the Control Page. Each time the page is refreshed, an XML request is sent and logged as a Read. Since the default refresh rate is 3 seconds, the log file can get cluttered by many XML request logs. By filtering out **Reads**, refresh requests will not be shown in the log. Likewise, by selecting **Writes**, any log created by changing the state of the output will not be shown in the log file. The default selection is **None**.

Next Log Time

This field displays the next periodic log time. If logging is disabled, the next log time will indicate "Disabled." If logging is enabled, but periodic logging is disabled (by selecting **Event Logging Only**) the next log time will indicate "Event Logging Only."

Note: This information is updated only when the page is refreshed.

2.4.7 Events Scheduler Tab

Events can be programmed to turn the Outputs ***ON*** and ***OFF*** at specific times. Up to 100 events can be created. Each event can occur one time or multiple times.

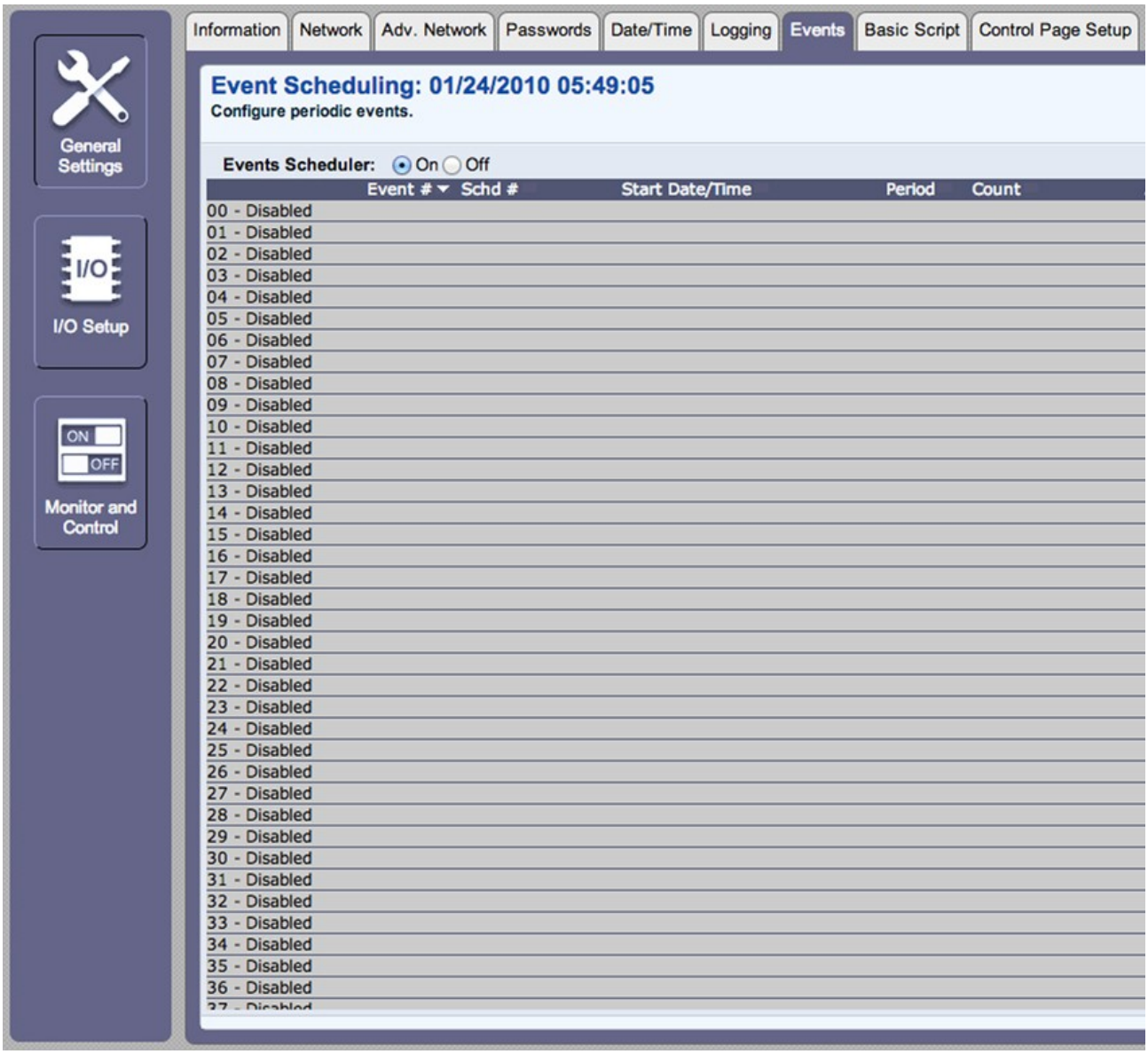


Figure 2.4i - Events Tab

A list of all scheduled events and information about each event is displayed in a table. Events can be sorted according to each column, in ascending or descending order. The following columns are displayed:

- ***Events Scheduler: On/Off***: Turns scheduled events ***ON*** or ***OFF***. ***ON*** is selected by default.
- ***Current Date/Time***: Displays the current date and time.
- ***Event #***: The number and name of events that are listed.
- ***Schd #***: The schedule where the event is located (0 is the default schedule).
- ***Start Date/Time***: The start date and time (24-hour) of the event.
- ***Period***: The time between the start of successive events.

- ***Count***: The number of times the event will occur.
- ***Action***: What action the outputs or schedule will take
- ***Act #(s)***: Which of the outputs or schedules, if any, will be affected by the event.
- ***Value***: If an output pulse event is programmed, the Pulse Duration will be displayed. If a set extVar(s) event is programmed, the new extVar value is displayed.
- ***Next Occurrence***: The date and time of the event's next occurrence will be displayed. If the event has already occurred, the event will be listed as “Inactive” here.

The events are color coded to indicate their status.

- Gray – Event has not been set up.
- Green – Events are active and will occur sometime in the future.
- Red – Events have been temporarily disabled by the disable event action.
- Yellow – Events have already occurred and are not scheduled to happen in the future.

Configuration of events is accomplished by clicking on the appropriate event, which causes the following setup screen to be displayed.

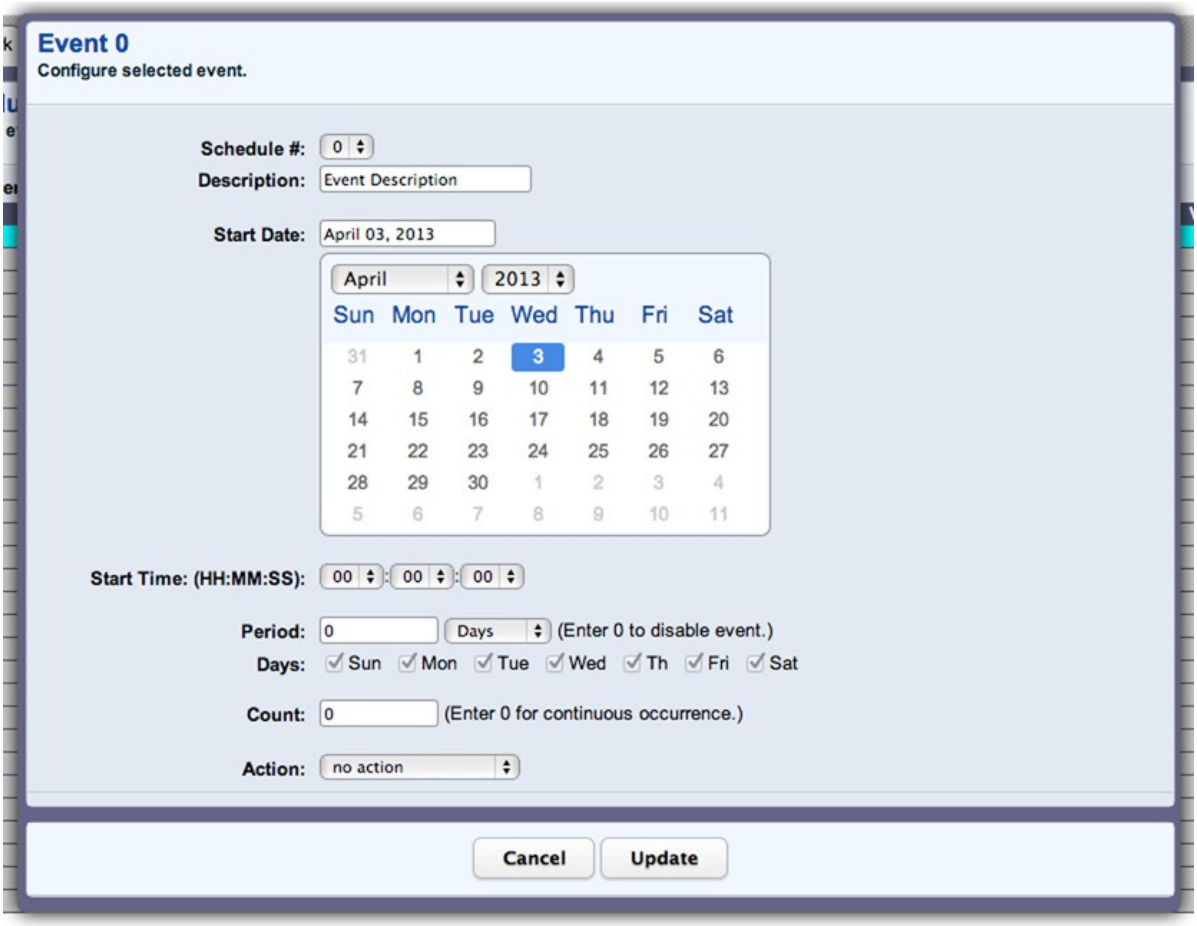

Event 0
Configure selected event.
Schedule #: 0
Description: Event Description
Start Date: April 03, 2013
April 2013
Sun Mon Tue Wed Thu Fri Sat
31 1 2 3 4 5 6
7 8 9 10 11 12 13
14 15 16 17 18 19 20
21 22 23 24 25 26 27
28 29 30 1 2 3 4
5 6 7 8 9 10 11
Start Time: (HH:MM:SS): 00 : 00 : 00
Period: 0 Days (Enter 0 to disable event.)
Days: Sun Mon Tue Wed Th Fri Sat
Count: 0 (Enter 0 for continuous occurrence.)
Action: no action
Cancel
Update

Figure 2.4j - Event Setup

Current Date/Time

This field displays the current date and time as specified in the **Date/Time** tab.

Schedule #

X-332™ can be setup to use multiple schedules. The master event schedule is schedule 0. (See following section, **Schedules** for more information.)

Description

Text entered here is used to name and describe each event. Default text is `Event Description`.

Start Date

This field is used to enter the start date of the event. The date is entered by first selecting the correct month and year by using the left and right arrows at the top of the calender. The single arrows (< and >) change the month and the double arrows (<< and >>) change the year. Once the current month and year are displayed, the date should be entered by selecting the day.

Start Time (HH:MM:SS)

The start time of the event is entered in the drop down menus as HH:MM:SS (HH represents hours in 24-hour format [00-23], MM represents minutes [00-59], SS represents seconds [00-59]). Default setting is 00:00:00.

Period

When events are configured to occur more than one time (any entry other than 1 in the Count below), the period field specifies the time between the beginning of events. This time can be specified in **Seconds**, **Minutes**, **Hours**, **Days,** or **Weeks** by selecting the appropriate option in the drop down menu. Default settings is 0 Days. Note that selecting 0 will disable the event.

Days

When a **Period** of one day is selected, the day (or days) on which that event will occur can be specified by marking the appropriate check boxes.

Count

The number of times the event will occur is specified. The default text is `0`. Note that entering 0 in this field will cause the event to occur continuously.

Action

This drop down menu specifies which action will take place when the event occurs. The following options may be selected

- ***no action***: When this option is selected, nothing will happen when event occurs.
- **turn relay(s) on**: This option causes the relay(s) specified in the Affected Relays(s) field to turn ***ON*** when event occurs.
- ***turn relays(s) off***: This option causes the relays(s) specified in the Affected Relays(s) field to turn ***OFF*** when event occurs.
- ***pulse relays(s)***: This option causes the relays(s) specified in the Affected Relays(s) field to turn ***ON*** when the event occurs, and then turn ***OFF*** after the Pulse Duration time (specified below) expires.
- ***toggle relays(s)***: This option causes the relays(s) specified in the Affected Relay(s) field to change states.
- ***change schedules***: This option causes the schedule(s) specified in the Affected field to be enabled or disabled. (See **Schedules** at the end of this section for more information).
- ***set extVar(s)***: External variables provide a way for scripts written in BASIC to interact with users, and for scripts to execute as a result of event occurrences. This option sets the extvar(s) specified in the Affected External Variables field to a specified value when the event occurs.

Affected Relay(s), Affected Schedules, Affected External Variables

Depending on the Action selected in the Action field, another field will appear with 4 check boxes. This field selects which relays,schedules,or external variables are affected by the action.

Pulse Duration

If the Output Action has been set to **pulse output(s)**, the **Pulse Duration** is set in this field. The time is specified in seconds and can range from 0.1 seconds to 86400 seconds in 0.1 second increments. The default time is 1.5 seconds.

ExtVar(s) Value

If the Action has been set to the Set ExtVar(s) action, then the new value for the extVar(s) is specified here.

Schedules

Events can be assigned to one of five schedules. The schedules are useful for creating complex events that vary with calendar dates, such as work shift alarms. Schedule 0 is always active, it cannot be disabled. Other schedules can be enabled and disabled by schedule events. Multiple schedules may be active at one time. The following is an example of how schedules and events might be used.

Schedule 0 – Events 1 & 2: Communication device is enabled daily at 8 pm and disabled at 6 am, Monday through Friday. (The web interface could be used to disable the system for any authorized exceptions.)

Field Name	Event 1	Event 2	Application Description
Schedule #	0	0	Schedule 0 cannot be disabled by other events.
Description	SCADA ON	SCADA OFF	User description of event.
Start Date	Current Day	Current Day	Set to current or previous day.
Start Time	20:00:00	06:00:00	Start time in 24 hr format.
Period	1 Days	1 Days	Event occurs daily.
Days	M-F	M-F	Security system is disabled during work hours and remains on over weekend.
Count	0	0	Event is always in effect, set to zero.
Action	turn output on	turn output off	Security system is controlled through Output 1.
Affected	1	1	Output 1 receives the Action
Pulse Duration	n/a	n/a	The value is ignored except for a pulse action.

Schedule 1 and 2 – Events 3-8: Radio transmission reports triggered at 8 am and 5 pm Monday through Friday, during winter months but, shifts to 6 am start time during summer.

Field Name	Event 3	Event 4	Event 5	Event 6	Event 7	Event 8
Schedule #	1	1	1	2	2	2
Description	Summer AM Report	Summer AM Report	End Summer	Winter AM Report	Winter AM Report	End Winter
Start Date	30 May	30 May	01 Sep	01 Sep	1 Sep	30 May
Start Time	08:00:00	17:00:00	00:00:00	06:00:00	03:00:00	00:00:00
Period	1 Days	1 Days	1 Days	1 Days	1 Days	1 Days
Days	M-F	M-F	All	M-F	M-F	All
Count	0	0	0	0	0	0
Action	pulse output	pulse output	change schedules	pulse output	pulse output	change schedules
Affected	1	1	2	1	1	1
Pulse Duration	3	3	n/a	3	3	n/a

In the above example, the **Affected** row applies to Outputs. When an output action is selected, or when a change schedule action is selected. The security system example could also be changed to schedules 1 and 2, allowing for different hours of operation for summer and winter schedules. Additional lunch or break bells could also be added to schedules 1 and 2 or added in schedules 3 and 4. Events 5 and 8 enable and disable schedules. Event 5 would enable schedule 2, and disable schedules 1,3,4. Event 8 would enable schedule 1, and disable schedules 2,3,4. Additional equipment could be controlled by event schedules such as lighting, compressors, and magnetic door locks.

2.4.8 Script Tab

X-332™ can be used to run simple custom programs written in a language similar to BASIC. This page is used to load and execute these programs. Before it can be loaded to the X-332™, a script must first be written as a .txt file. The file must then be uploaded to X-332™ via the Basic Script tab (the maximum size of script that can be uploaded to the device is 2K bytes). Information on writing a basic program for X-332™ can be found in **Appendix G: Basic Scripts**.

Figure 2.4k - Script Tab

Note: An ASCII standard text file format should be used, such as Windows Notepad, Programmer's Notepad, vi, or other text editor that output the file as a .txt. Rich Text Format (.rtf) used by Microsoft WordPad is NOT compatible.

BASIC Script

This field displays the .txt file that is uploaded to X-332™. Text displayed in this screen cannot be edited. In order to edit any script, it must be rewritten in the .txt file and uploaded to the unit again.

Interpreter Status

This field displays whether the program is continuing to run, has stopped or finished, or if there are errors contained in the script. If there are errors in the script, the line on which the error occurred is displayed.

Upload BASIC Script

This field displays the script selected to be uploaded to the device. To upload a script to X-332™, click the 'Choose File' button, find the .txt file previously created, and select 'Open.' The location of the file should appear in the neighboring field. To upload the script to the unit, select 'Submit.'

Run Script

This option selects whether or not the selected script will be run after it has been uploaded. The Submit button must be clicked to run the script.

2.4.9 Control Page Setup Tab

The **Control Page Setup** page is used mainly to set parameters that affect the view of the **Control Page**, how often it will refresh, etc.

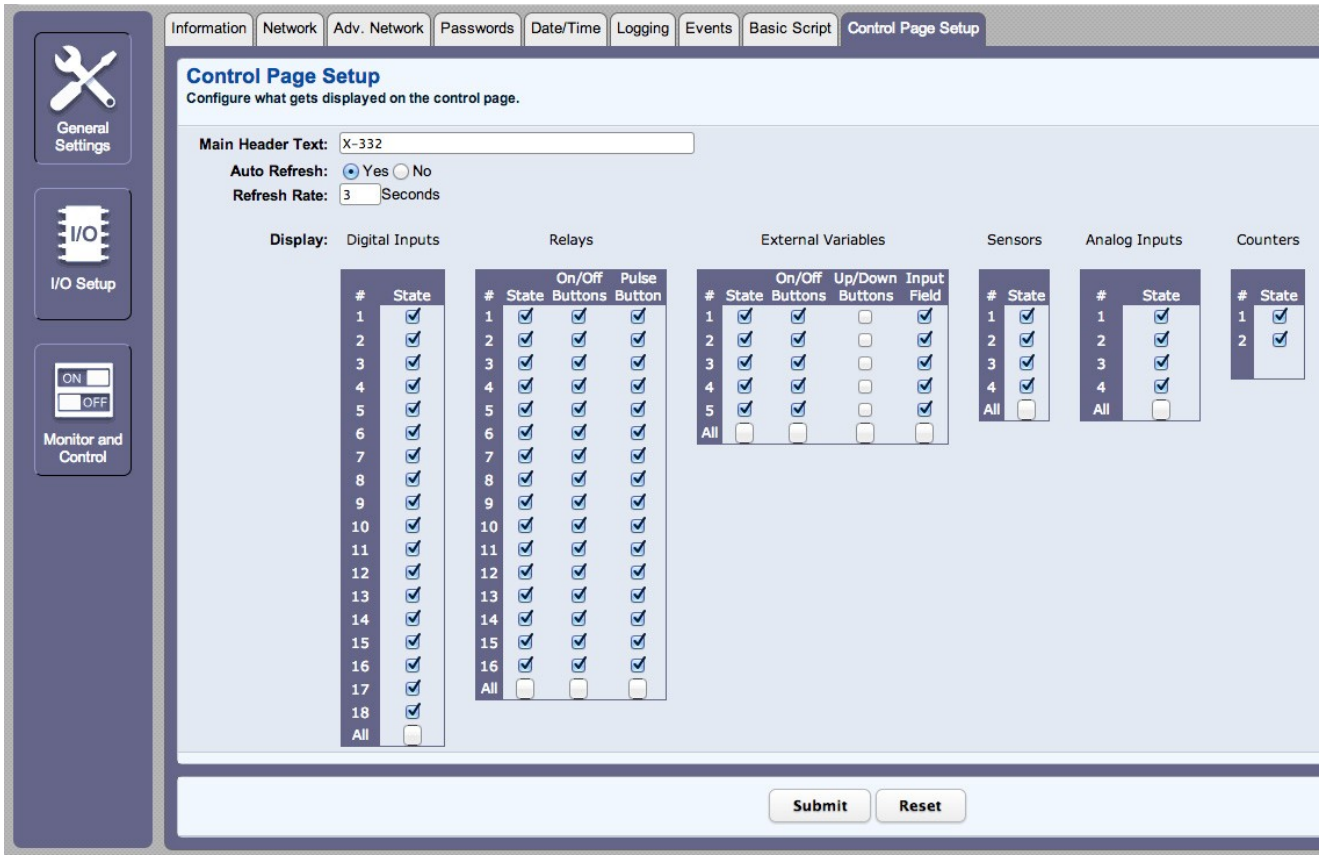


Figure 2.4l - Control Page Setup Tab

Main Header Text

The text entered here appears at the top of the **Control Page**. It also appears in the header of the email text when the email notification is used. This field can be up to 40 characters in length. The default text is `X-332`.

Auto Refresh

The Auto Refresh Page option will cause the **Control Page** to continually update its contents by setting a timer in the web page that causes it to be reloaded at a specified time interval. When set to ***Yes***, the web page will be refreshed at the time interval specified in the Refresh Rate setting. When set to **No**, the web page will need to be manually refreshed to show the current status of the unit on the control page.

Refresh Rate

When the Auto Refresh Page option is set to ***Yes***, this field specifies the time interval in seconds that the page will be refreshed. It can be set from 1 to 32 seconds. The default Refresh Rate is `3` seconds.

Display

This section is used to select which inputs, relays, external variables, pulse counters, sensors get displayed on the control page. There are six configuration tables. Some tables, such as the digital inputs table, have one column of check boxes. Each check box determines whether or not the status of the element is displayed. Other tables, such as the relays table, have multiple columns. The first column determines if the relay status is displayed on the control page. Other columns determine what control buttons are displayed on the control page.

- Inputs (1-18) – Determines if the input status is visible on the control page.
- Relays (1-16) – Determines if the relay status is visible on the control page. Also, the visibility of On/Off buttons and Pulse buttons can be configured through the check boxes in columns two and three.
- External Variables (1-5) – Determines if the external variables are visible on the control page. On/Off buttons, Up/Down arrows, and Input boxes can all be enabled/disabled through the check boxes in columns three through five.
- Sensors (1-4) – Determines the visibility of the sensor readings on the control page.
- Pulse Counters (1-2) – Determines the visibility of the counter values on the control page.
- Analog Inputs (1-4) – Determines whether or not the analog measurement is displayed on the control page.

2.5 X-332™ I/O Setup Pages

The second set of setup pages, the I/O Setup pages, are used to configure all the I/O related settings of the device. Accessing these setup pages is the same as all the other setup page. The X-332™ is configured using a web browser. To access the setup pages, enter the following URL in the address bar of a web browser:

```
http://{ipaddress}/setup.html
```

For example, using the default IP address, enter:

http://192.168.1.2/setup.html

When initially accessing the device, the browser will request a username and password. The default username is `admin` and the default password is `webrelay` (password is case sensitive).

To access the I/O setup pages, choose I/O Setup on the menu bar on the left side of the setup screen.

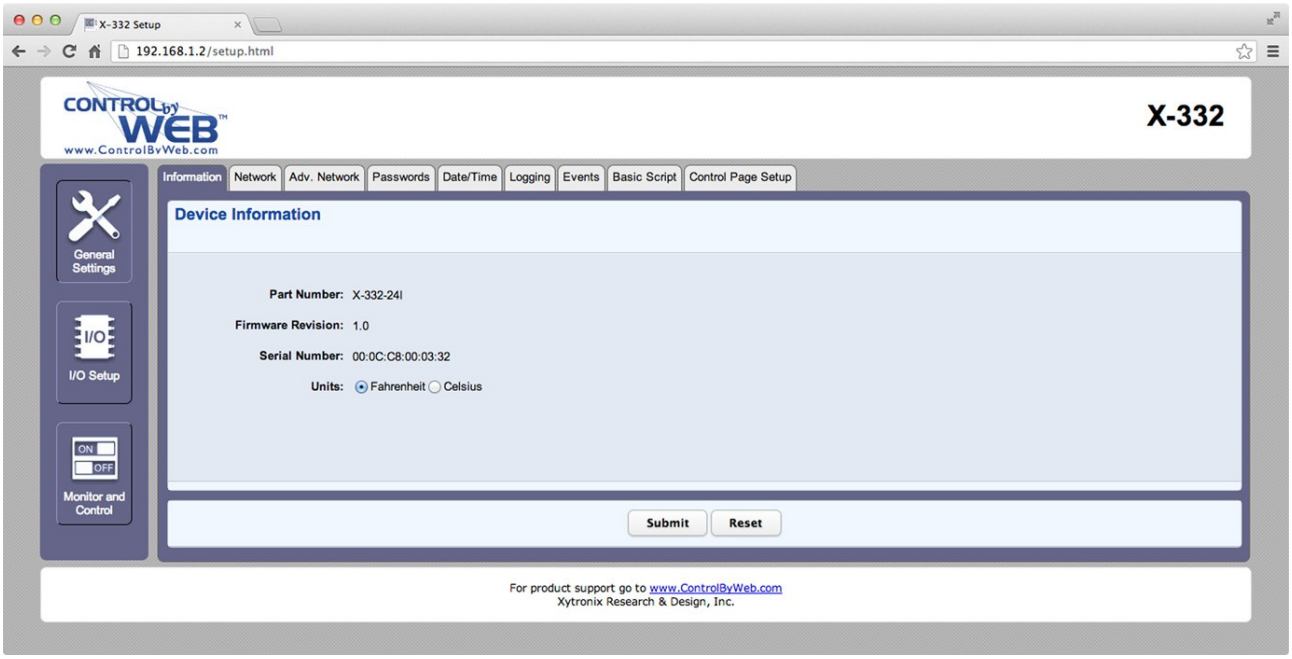


Figure 2.5a - Setup Page

2.5.1 Digital Input Tab

This page provides configuration options for the sixteen digital inputs built into the X-332™.

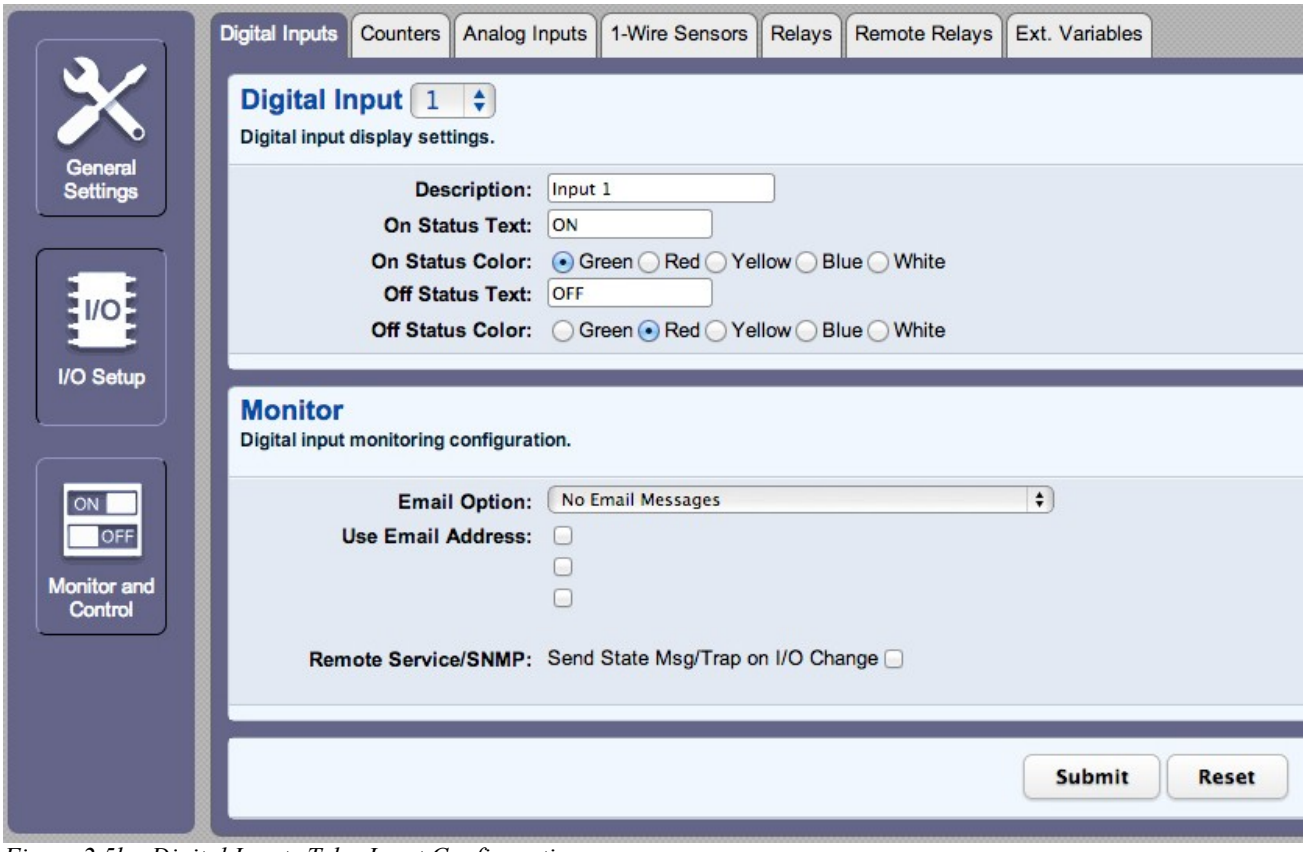


Figure 2.5b - Digital Inputs Tab - Input Configuration

Digital Input

A drop-down menu is used to select the digital input to configure.

Description

This text field is used to describe the function of the selected input. The text appears to the left of the corresponding input status on the **Control Page**, and in email messages when email alerts are enabled. This field may be up to 14 characters long. The default text is Input #.

On Status Text

The text in this field specifies the text that will be displayed in the **Control Page** and in email messages when the input is ***ON***. Up to 10 characters may be entered in this field. The default text is ON.

On Status Color

This field specifies the color that will be displayed on the control page when the input is considered On. Options are Green, Red, Yellow, Blue and White. The default color is Green.

Off Status Text

The text in this field specifies the text that will be displayed in the control page and in email messages when the input is ***OFF***. Up to 10 characters may be entered in this field. The default text is `OFF`.

Off Status Color

This field specifies the color that will be displayed on the control page when the input is considered Off. Options are Green, Red, Yellow, Blue and White. The default color is Red.

Email Option

Simple email messages can be sent in response to input changes. This parameter is used to specify what input changes, if any, will cause email messages to be sent. The default setting for this field is **No Email Messages**.

- ***No Email Messages***: No email notifications will be sent due to input changes.
- ***Send Email when input on***: Email notifications will be sent when input state changes to On.
- ***Send Email when input off***: Email notifications will be sent when input state changes to ***OFF***.
- ***Send Email when input changes state***: Email notifications will be sent when input changes state to ***ON*** or ***OFF***.

*Note: Email notification will work only if the email settings are correctly set up in the **Network** setup page.*

Use Email Address

If email messages are to be sent out based on input changes, these check boxes specify to which email addresses the message will be sent. Email addresses specified on the **Network** setup tab will be displayed next to each check box. By default, no boxes are checked.

Remote Service/SNMP

When this box (Send State Msg/Trap on Input Change) is checked, SNMP traps and/or State messages will be sent whenever the input state changes.

2.5.2 Counters Tab

This page provides configuration options for the two counter inputs. Inputs 17 and 18 *(refer to page 22)* can be configured to be used as counters, counter one corresponds to input 17 and counter two corresponds to input 18.

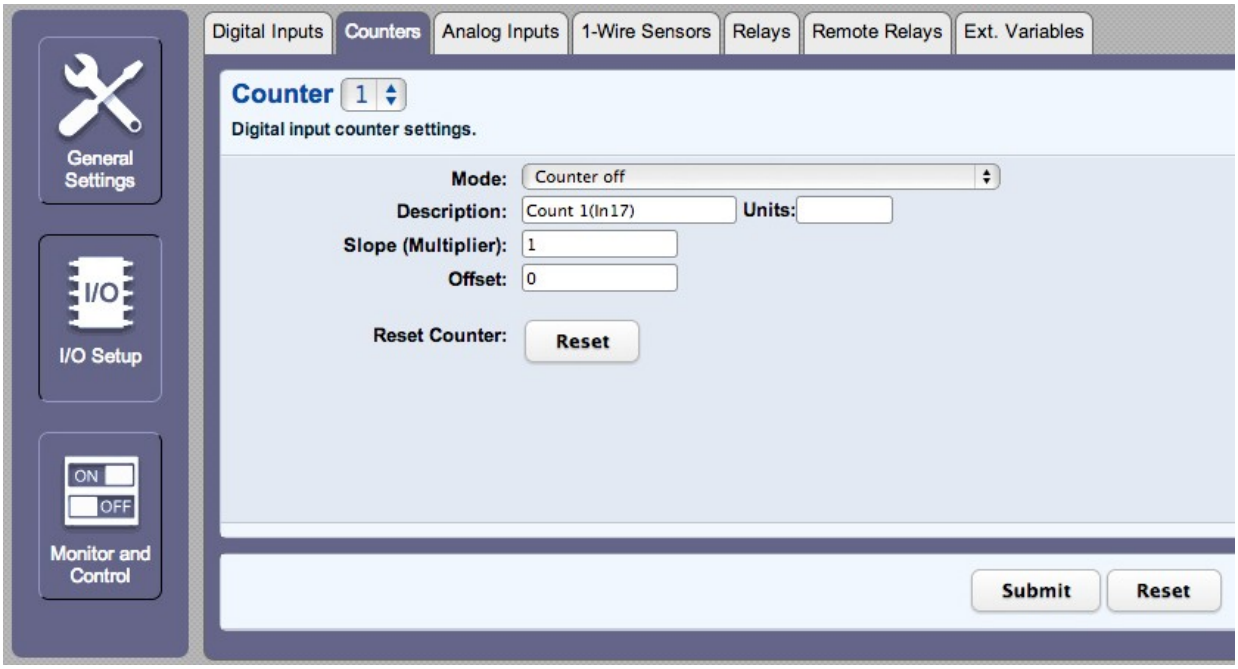


Figure 2.5c - Counters Tab - Input Configuration

Counter

A drop-down menu is used to select the counter to configure.

Mode

This settings determines what triggers the counter to increment.

- ***Counter off:*** No input transitions will be counted.
- ***Increment when input on:*** The counter will increment when the input is asserted (input tied to ground).
- ***Increment when input off:*** The counter will increment when the input is no longer asserted (input open).
- ***Increment when input changes:*** The counter will increment each time the input changes on or off.

Note the default setting for this field is ***Counter off****.*

Description

This text field is used to describe the counter. The text appears to the left of the corresponding counter on the Control Page, and in email messages when email alerts are enabled. This field may be up to 14 characters long. The default text is Count #.

Units

This text field is used to describe the units counted. The text appears to the right of the counter reading. This field may be up to 6 characters long.

Slope (Multiplier)

The counter can be scaled to represent “real-world” units. X-332™ reads the “raw” value from each counter, and calculates the number that represents the “real-world” measurement. This scaled value is calculated using the following linear formula. (Range: -86400.000 to +86400.000).

*Scaled Value = Slope * Count + Offset*

The calculated scaled value is used for trigger logs, email messages, control page, XML page, and returned when Modbus values are read.

The “slope” in the formula above is provided by the user and is entered in this field. When both the slope and offset are set to their default values, 1 and 0, respectively, the scaled value equals the actual count.

When the counter is set to whole number mode, the slope multiplier is truncated, all digits to the right of the decimal place are ignored.

Offset

The “offset” in the formula above is provided by the user and is entered in this field. The default value for this field is 0. (Range: -86400.000 to +86400.000).

Reset Counter

This button will reset the counter to zero.

2.5.3 Analog Inputs Tab

This page provides configuration options for the four analog inputs built into the X-332™.

Note: All 4 Analog Inputs have an input range of 0-5 VDC

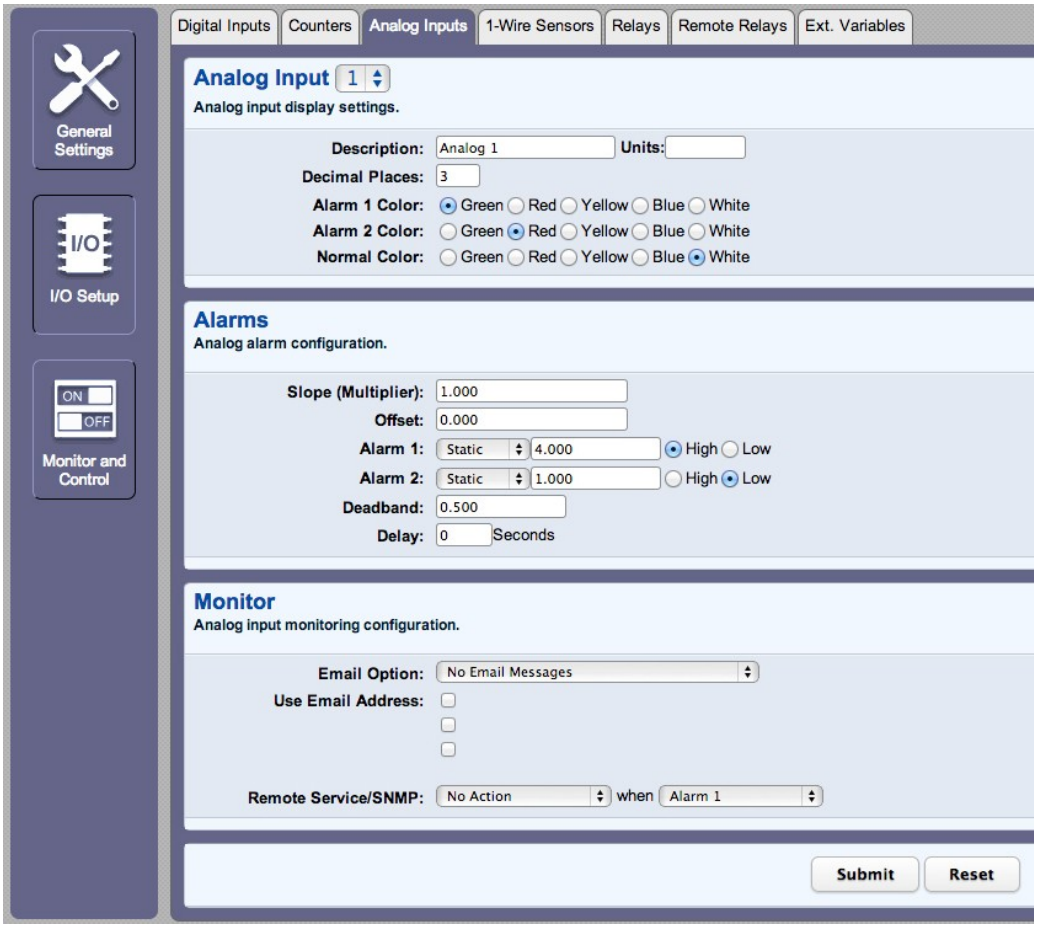


Figure 2.5d – Analog Inputs Tab - Input Configuration

Description

This text field is used to describe the analog input. By default it is set to "Analog #." The text appears to the left of the analog input status on the **Control Page**. This text will also appear in email messages when email alerts are enabled. This field may be up to 14 characters long.

Units

This text field is used to define the units of the sensor connected to the analog input. This text appears after the analog input status on the **Control Page**. This text will also appear in email messages when email alerts are enabled. This field may be up to 6 characters long.

Decimal Places:

This text field is used to specify the number of digits shown on the right of the decimal point on the control page. The minimum number of decimal places shown is 0. The maximum number of decimal places shown is 3. The default for this field is 3.

Alarm 1 Color

The selected color that will be displayed on the Control Page when Alarm 1 is reached. Options are Green, Red, Yellow, Blue and White. The default setting is Green.

Alarm 2 Color

The selected color that will be displayed on the Control Page when Alarm 2 is reached. Options are Green, Red, Yellow, Blue and White. The default setting is Red.

Normal Color

This field specifies the color that will be displayed on the Control Page when the input voltage is in a Normal condition. Options are Green, Red, Yellow, Blue and White. The default setting is White.

Slope (Multiplier)

The analog inputs have an input range from 0-5 VDC. In many cases, the inputs must be scaled to represent “real-world” measurements that are outside the range of 0-5 VDC. The X-332™ reads the “raw” value from each input, and calculates the number that represents the “real-world” measurement that the user is actually interested in. This real-world value (referred to as the “scaled” value in this manual) is calculated using the following linear formula.

Scaled Value = Slope * Input Voltage + Offset

The Scaled Value is displayed on the Control Page, used to determine alarm conditions, and shown in email messages.

“Slope” in the formula above is provided by the user and is entered in this field. The value is used to scale the 0-5 VDC input to the range of detected condition. For example, a pressure sensor may have a 0.1-4.5 VDC output representing 0 to 50 psi. The multiplier would be calculated as follows.
50 V / (4.5 V - 0.1 V) = 11.36
11.36 would be entered in the multiplier field.

The default value for this field is 1.

When the slope is set to 1 and offset is 0 (default values), the Scaled Value equals the Input Voltage value.

The Scaled Value is also used for the Digital Mode thresholds.

Offset

The “Offset” is used for the “zero” measurement. In the above example the offset would be set at 0.1.

The default value for this field is 0. When both the slope and offset are set to their default values, the Scaled Value equals the Raw Voltage.

Alarm 1

This setting is used to set the trigger point for an alarm condition. The number field specifies a static value at which the alarm is triggered. An external variable can also be chosen as the alarm value. The High and Low radio buttons indicate whether the alarm is triggered as a high or low alarm. A high alarm is triggered when the Scaled Value of the analog input exceeds the Alarm 1 set point. A low alarm occurs when the Scaled Value of the analog input is lower than the alarm set point.

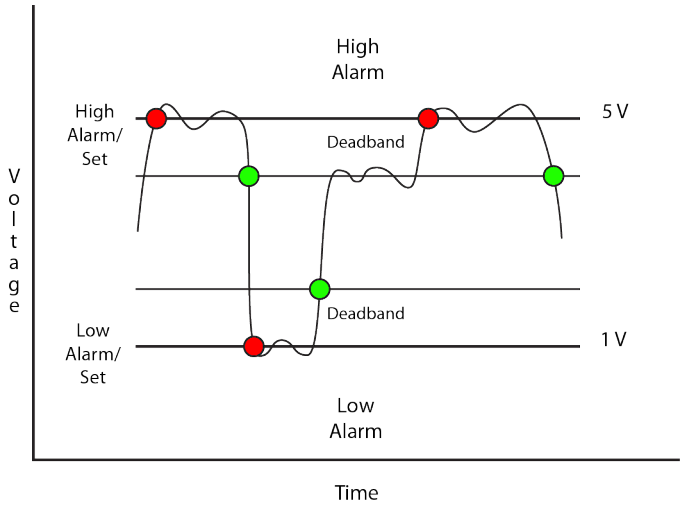
Alarm 2

This is a second alarm trigger that works identical to Alarm 1.

Deadband

The Deadband prevents alarms from triggering excessively when the analog measurement vacillates around the trigger point. With high alarms, the measurement must fall below the high alarm point minus the deadband before the high alarm will be triggered again. Likewise the deadband on the low alarm requires the measurement to rise above the low alarm point plus the deadband before the low alarm will be triggered again.

For example, if the deadband is set to 0.5 V, and a high alarm occurs at 5 V, the alarm will not trigger again until the voltage first drops below 4.5 V (5 V - 0.5 V).



Delay

The range for the Analog Input Delay is 0 to 3600 seconds. This allows the user to set a time period that the device will wait before triggering an alarm. For example, if sensor 1 is configured to trigger an alarm when the sensor is above 4.000 V and the *Delay* has been set to 20 seconds, then there will be a delay of 20 seconds after the sensor goes above 4.000 V before the alarm is triggered. At the end of the 20 second delay, before the alarm is triggered, the sensor reading will be checked again, if the reading has dropped below 4.000 V, no alarm will be triggered.

Email Option

Simple email messages can be sent in response to alarm conditions. This parameter is used to specify what alarm conditions, if any, will cause email messages to be sent. Email notification will work only if email is correctly setup in the **Network** setup page.

- ***No Email Messages****:* No email messages will be sent due to alarm conditions.
- ***Send Email on Alarm 1***: Email notifications will be sent due to Alarm 1 conditions.
- ***Send Email on Alarm 2*****:** Email notifications will be sent due to Alarm 2 conditions.
- ***Send Email on Alarm 1 and Alarm 2*****:** Email notifications will be sent due to Alarm 1 or Alarm 2 conditions.
- ***Send Email on Alarm 1, Alarm 2, and Normal*****:** Email notifications will be sent due to Alarm 1, Alarm 2, or when Normal conditions are regained.

Use Email Address

If email messages are to be sent based on alarm conditions, these check boxes specify to which email addresses the message will be sent. Email address specified on the **Network** setup tab will be shown next to each check box.

Remote Service/SNMP

This field specifies the action with a remote server due to an alarm condition.

- ***No Action***: No action is taken.
- ***Send State Msg/Trap***: An event string will be sent to the remote server.

The second drop down box specifies the conditions that will cause an alarm trigger. The following alarm conditions are available:

- ***Alarm 1***: The specified action occurs due to Alarm 1.
- ***Alarm 2***: The specified action occurs due to Alarm 2.
- ***Alarm 1 or Alarm 2****: The specified action occurs due to Alarm 1 or Alarm 2.*

2.5.4 1-Wire Sensors Tab

This tab is used to configure temperature/humidity sensors and associated alarms. X-332™ will automatically detect whether a temperature or humidity sensor is connected.

Sensor

Up to four sensors can be connected to X-332™. This drop-down list selects the sensor to be configured. The fields below are the same for each sensor.

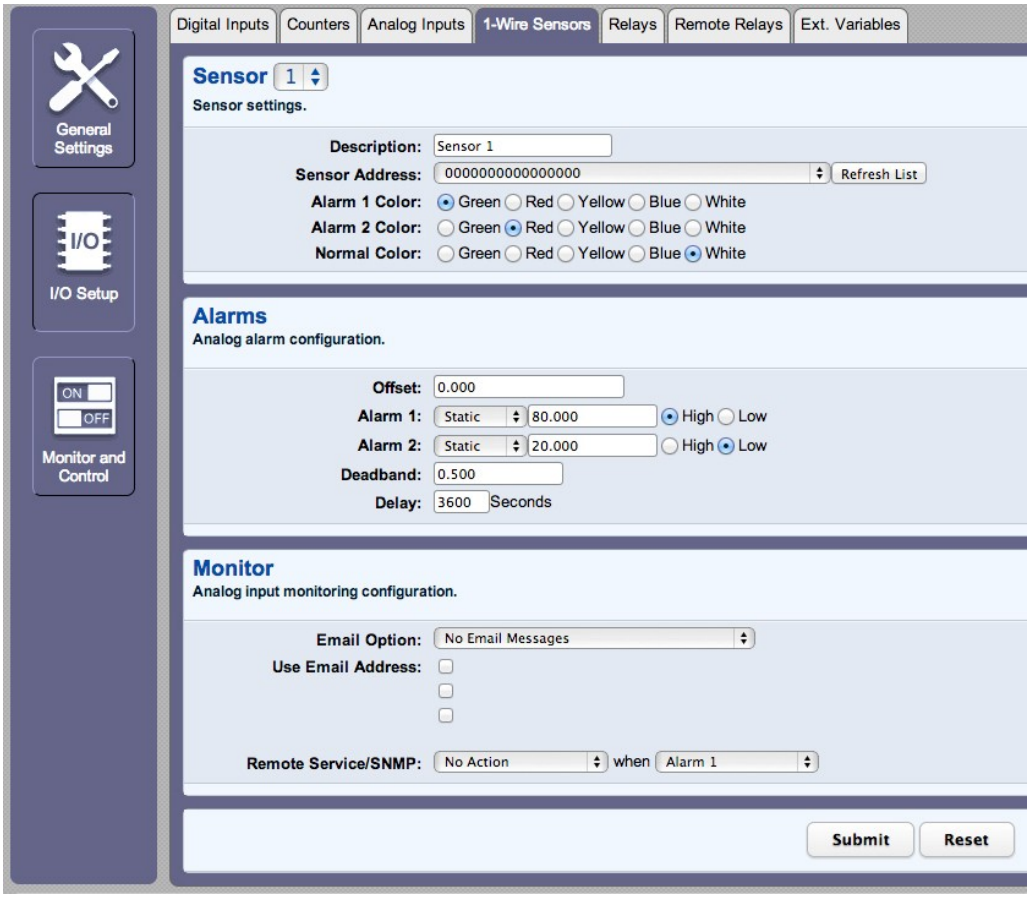


Figure 2.5e – 1-Wire Sensors Tab

Sensor Description

The text in this field appears to the left of the corresponding temperature/humidity reading on the Control Page. This text also appears in the email status message when email is enabled. This field can be up to 13 characters in length. The default text in this field is Sensor #.

Sensor Address

Each sensor connected to X-332™ should be associated (or assigned) to a sensor number. This identifies the name, location, and function of the sensor. Every temperature/humidity sensor comes from the factory with a unique, non-changeable address. When the sensors tab is selected (or the Refresh List button is pressed), X-332™ scans the bus for sensors. The addresses of the sensors that are found on the bus are listed in the drop-down list. For each sensor number (Sensor 1... Sensor 3), select the address of the appropriate sensor from the drop-down list.

Selecting sensors is simplest when the sensors are connected to the bus one at a time. The procedure is to start with one sensor and associate it with the appropriate sensor number by selecting the sensor address within the appropriate drop-down list. Submit the page, connect a second sensor, and press the Refresh List button. Associate the second sensor to the appropriate sensor number. Continue this procedure until all sensors are set up.

Alarm 1 Color

This field specifies the color that will be displayed on the Control Page when Alarm 1 is reached. Options are Green, Red, Yellow, Blue and White. The default color is Green.

Alarm 2 Color

This field specifies the color that will be displayed on the Control Page when Alarm 2 is reached. Options are Green, Red, Yellow, Blue and White. The default color is Red.

Normal Color

This field specifies the color that will be displayed on the Control Page when the sensor is in a Normal condition. Options are Green, Red, Yellow, Blue and White. The default color is White.

Offset

The value of the offset will be added to the sensor's reading. Normally this should be set to zero.

Alarm 1

This setting is used to set the trigger point for an alarm condition. The number field specifies the temperature/humidity at which the alarm is triggered. The “High” and “Low” radio buttons indicate whether the alarm is triggered as a high or low alarm. A high alarm is triggered when the sensor reading exceeds the alarm value, and a low alarm is occurs when the sensor reading falls below the alarm value. Generally this value will be static, but an external variable can be used as a trigger point for an alarm condition as well. To use an external variable select the desired external variable using the drop down box. The value of an external variable can be changed by the event scheduler, through a basic script, and directly through the control page.

Alarm 2

This is a second alarm trigger that works similar to Alarm 1.

Deadband

The Deadband prevents alarms from triggering excessively when the sensor measurement vacillates around the trigger point.

With high alarms, the measurement must fall below the high alarm point minus the deadband before the high alarm will be triggered again. Likewise the deadband on the low alarm requires the measurement to rise above the low alarm point plus the deadband before the low alarm will be triggered again.

For example, if the deadband is set to 1 degree, and a high alarm is occurs at 95 degrees, the dead band ensures that once the high alarm is triggered, it won't trigger again until the temperature first drops below 94 degrees (95 – 1).

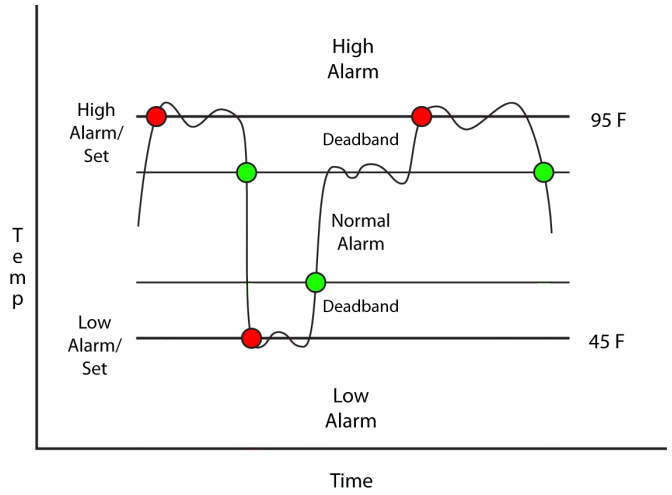


Figure 2.5f - Alarm Deadband

Delay

The range for the Email/Action Delay is 0 to 3600 seconds. This allows the user to set a time period that the device will wait before triggering an alarm. For example, if sensor 1 is configured to trigger an alarm when the temperature is above 80 degrees and the *Delay* has been set to 20 seconds, then there will be a delay of 20 seconds after the temperature goes above 80 degrees before the alarm is triggered. At the end of the 20 second delay, before the alarm is triggered, the temperature will be checked again, if the temperature has dropped below 80 degrees, no alarm will be triggered.

Email Option

Simple email messages can be sent in response to alarm conditions. This parameter is used to specify what alarm conditions, if any, will cause email messages to be sent. Note that email notification will work only if email is correctly setup in the **Network** setup page.

- ***No Email Messages***: No email messages will be sent due to alarm conditions.
- ***Send Email on Alarm 1***: Email notifications will be sent due to Alarm 1 conditions.
- ***Send Email on Alarm 2***: Email notifications will be sent due to Alarm 2 conditions.
- ***Send Email on Alarm 1 and Alarm 2***: Email notifications will be sent due to Alarm 1 or Alarm 2 conditions.
- ***Send Email on Alarm 1, Alarm 2, and Normal***: Email notifications will be sent due to Alarm 1, Alarm 2, or when normal conditions are regained.

Use Email Address

If email messages are to be sent out based on alarm conditions, these check boxes specify to which email addresses the message will be sent. Email address specified on the **Network** setup tab will be shown next to each check box.

Remote Service/SNMP

This field specifies the action with a remote server due to an alarm condition.

- ***No Action***: No action is taken.
- ***Send State Msg/Trap***: An event string will be sent to the remote server.

The second drop down box specifies the conditions that will cause an alarm trigger. The following alarm conditions are available:

- ***Alarm 1***: The specified action occurs due to Alarm 1.
- ***Alarm 2***: The specified action occurs due to Alarm 2.
- ***Alarm 1 or Alarm 2***: The specified action occurs due to Alarm 1 or Alarm 2.

2.5.5 Relay Setup Tab

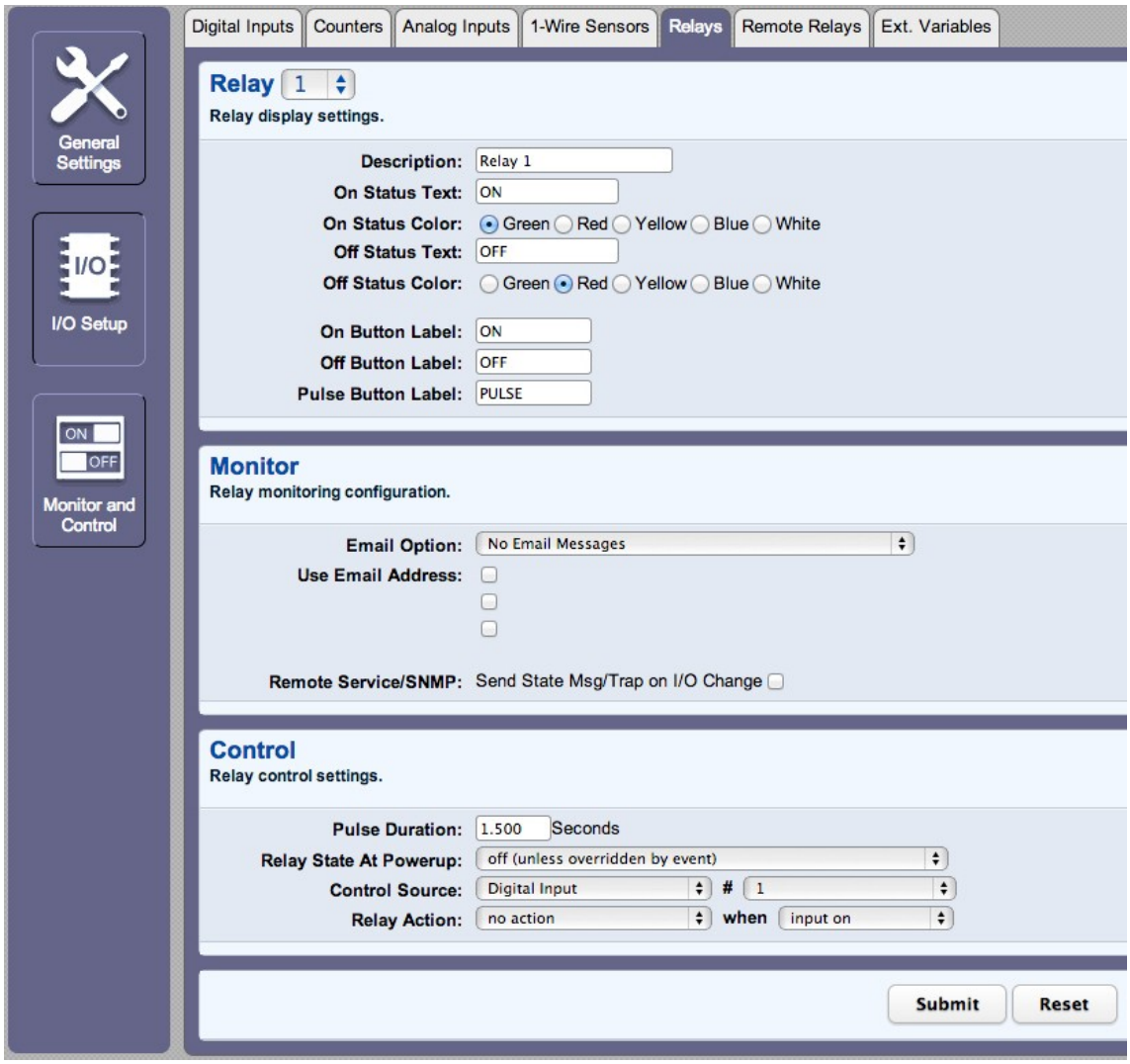


Figure 2.5g - Relays Tab

Relay

This drop down menu is used to select the relay to configure.

Description

This text field is used to describe the function of the selected relay. The text appears to the left of the corresponding relay status on the **Control Page** and in the email message when email alerts are

enabled. Up to 12 characters may be entered in this field. The default text is `Relay #`.

On Status Text

The text in this field specifies the text that will be displayed in the **Control Page** and in email messages when the relay is ***ON***. Up to 10 characters may be entered in this field. The default text is `ON`.

On Status Color

This field specifies the color that will be displayed on the control page when the relay is considered On. Options are Green, Red, Yellow, Blue and White. The default color is Green.

Off Status Text

The text in this field specifies the text that will be displayed in the control page and in email messages when the relay is ***OFF***. Up to 10 characters may be entered in this field. The default text is `OFF`.

Off Status Color

This field specifies the color that will be displayed on the control page when the relay is considered Off. Options are Green, Red, Yellow, Blue and White. The default color is Red.

On Button Label

The text entered in this field appears in the 'On' button for the corresponding output on the **Control Page**. Up to 8 characters may be entered in this field. The default text is `ON`.

Off Button Label

The text entered in this field appears in the 'Off' button for the corresponding output on the **Control Page**. Up to 8 characters may be entered in this field. The default text is `OFF`.

Pulse Button Label

The text entered in this field appears in the 'Pulse' button for the corresponding output on the Control Page. Up to 8 characters may be entered in this field. The default text is `PULSE`.

Email Option

Simple email messages can be sent in response to relay state changes. This parameter is used to specify what relay state changes, if any, will cause email messages to be sent. Note that email notification will work only if the email settings are correctly set up in the **Network** setup page. The following options are available:

- ***No Email Messages***: No email notifications will be sent due to relay state changes.
- ***Send Email when input on***: Email notifications will be sent when relay state changes to ON.
- ***Send Email when input off***: Email notifications will be sent when relay state changes to *OFF*.
- ***Send Email when input changes state***: Email notifications will be sent when relay changes state to *ON* or *OFF*.

*Note: The default setting for this field is **No Email Messages**.*

Use Email Address

If email messages are to be sent out based on relay state changes, these check boxes specify to which email addresses the message will be sent. Email addresses specified on the **Network** setup tab will be displayed next to each check box. By default, no boxes are checked.

Remote Service/SNMP

When this box (Send State Msg/Trap on Relay Change) is checked, SNMP traps and/or State messages will be sent whenever the relay state changes. Remote Services or SNMP must be enabled and properly configured for this feature to be effective.

Pulse Duration

When X-332™ receives a pulse command for the relay (through the web page or through a command), the relay will pulse for the time specified in this field. Note that when a pulse command is sent through the command interface, the command can include a pulse time which will over-ride this value (for that pulse only). The time is specified in seconds and can range from `0.1` seconds to `86400` seconds in 0.1 second increments. The default time is `1.5` seconds.

State at Powerup

This drop down menu lets the user specify the state of each of the relays when the X-332™ is powered up. The following options can be selected:

- ***off (unless overridden by event):*** The relay will be off upon power up. This is the default setting.
- ***on (unless overridden by event):*** The relay will be on when power is applied to the X-332™.
- ***last state (unless overridden by event)*****:** Upon power up, the relay will return to its last state when the X-332™ was powered off.

Control Source and #

These drop down menus specify what input/sensor/relay controls the state of the relay. The following options can be selected:

- ***Digital Input:*** The state of the relay will be controlled by a digital input.
- ***Analog Input:*** The state of the relay will be controlled by a analog input.
- ***1-Wire Sensor*****:** The state of the relay will be controlled by a 1-Wire Sensor (temperature or humidity)
- ***Relay*****:** The state of the relay will be controlled by the state of another relay.

Depending on the Control Source selected, the # drop down menu will change. For example, when Digital Input is selected, the # drop down menu will have options 1-18. If Analog Input is selected, the # drop down menu will have options 1-4. If a Relay control source is selected then the # drop down menu will have options 1-16 accept for the number of the relay currently being configured. Relays cannot be configured to control themselves.

Relay Action – when –

These drop down menus specify what action to take when a criteria is met. The available actions are the same regardless of the control source. The options in this drop-down list change depending on which control source has been selected. The following table describes the options available.

Control Source	Available Options	Description
Digital Input	no action **when** input on	Input has no effect on relay
	no action **when** input off	Input has no effect on relay
	no action **when** input changes	Input has no effect on relay
	turn on **when** input on	Relay turns on when input turns on. Relay turns off when input turns off.
	turn on **when** input off	Relay turns off when input turns on. Relay turns on when input turns off.
	turn on **when** input changes	Relay turns turns when input changes state. Input change does not turn relay back off.
	turn off **when** input on	Relay turns off when input turns on. Relay turns on when input turns off.
	turn off **when** input off	Relay turns off when input turns off. Relay turns on when input turns on.
	turn off **when** input changes	Relay turns off when input changes state. Input change does not turn relay back on.
	latch on **when** input on	Relay turns on when input turns on. Once on, the relay can only be turned off through other means. (Control page, modbus, etc.)
	latch on **when** input off	Relay turns on when input turns off. Once off, the relay can only be turned on through other means. (Control page, modbus, etc.)
	latch on **when** input changes	Relay turns on when input changes state. Once off, the relay can only be turned on through other means. (Control page, modbus, etc.)
	latch off **when** input on	Relay turns off when input turns on. Once off, the relay can only be turned on through other means. (Control page, modbus, etc.)
	latch off **when** input off	Relay turns off when input turns off. Once off, the relay can only be turned on through other means. (Control page, modbus, etc.)
	latch off **when** input changes	Relay turns on when input changes state. Once off, the relay can only be turned on through other means. (Control page, modbus, etc.)
	toggle **when** input on	Relay toggles state when input turns on. Relay maintains current state when input turns off.
	toggle **when** input off	Relay toggles state when input turns off. Relay maintains current state when input turns on.
	toggle **when** input changes	Relay toggles state when input turns off. Relay toggles state when input turns on.
	pulse **when** input on	Relay pulses on when input turns on. Uses pulse duration setting.
	pulse **when** input off	Relay pulses on when input turns off. Uses pulse duration setting.

	pulse **when** input changes	Relay pulses on when input changes state. Uses pulse duration setting.
Analog Input/ 1-Wire Sensors	no action **when** alarm 1	Sensor has no effect on relay.
	no action **when** alarm 2	Sensor has no effect on relay.
	no action **when** alarm 1 or alarm 2	Sensor has no effect on relay.
	turn on **when** alarm 1	Relay turns on when there is an alarm 1 condition for sensor. Relay turns off when there is no alarm 1 condition. (Alarm 1 condition configured on sensor tab)
	turn on **when** alarm 2	Relay turns on when there is an alarm 2 condition for sensor. Relay turns off when there is no alarm 2 condition. (Alarm 2 condition configured on sensor tab)
	turn on **when** alarm 1 or alarm 2	Relay turns on when there is either an alarm 1 or alarm 2 condition for sensor. Relay turns off when there is no alarm 1 or alarm 2 condition. (Alarm conditions configured on sensor tab)
	turn off **when** alarm 1	Relay turns off when there is an alarm 1 condition for sensor. Relay turns on when there is no alarm 1 condition. (Alarm 1 condition configured on sensor tab)
	turn off **when** alarm 2	Relay turns off when there is an alarm 2 condition for sensor. Relay turns on when there is no alarm 2 condition. (Alarm 2 condition configured on sensor tab)
	turn off **when** alarm 1 or alarm 2	Relay turns of when there is either an alarm 1 or alarm 2 condition for sensor. Relay turns on when there is no alarm 1 or alarm 2 condition. (Alarm conditions configured on sensor tab)
	latch on **when** alarm 1	Relay turns on when there is an alarm 1 condition for sensor. Once on, the relay stays on until reset by other means. (Alarm 1 condition configured on sensor tab)
	latch on **when** alarm 2	Relay turns on when there is an alarm 2 condition for sensor. Once on, the relay stays on until reset by other means. (Alarm 2 condition configured on sensor tab)
	latch on **when** alarm 1 or alarm 2	Relay turns on when there is either an alarm 1 or alarm 2 condition for sensor. Once on, the relay stays on until reset by other means. (Alarm conditions configured on sensor tab)
	latch off **when** alarm 1	Relay turns off when there is an alarm 1 condition for sensor. Once off, the relay stays off until reset by

		other means. (Alarm 1 condition configured on sensor tab)
	latch off **when** alarm 2	Relay turns off when there is an alarm 2 condition for sensor. Once off, the relay stays off until reset by other means. (Alarm 2 condition configured on sensor tab)
	latch off **when** alarm 1 or alarm 2	Relay turns of when there is either an alarm 1 or alarm 2 condition for sensor. Once off, the relay stays off until reset by other means. (Alarm conditions configured on sensor tab)
	toggle **when** alarm 1	Relay toggles state when there is an alarm 1 condition for sensor. (Alarm 1 condition configured on sensor tab)
	toggle **when** alarm 2	Relay toggles state when there is an alarm 2 condition for sensor. (Alarm 2 condition configured on sensor tab)
	toggle **when** alarm 1 or alarm 2	Relay toggles state when there is either an alarm 1 or alarm 2 condition for sensor. (Alarm conditions configured on sensor tab)
	pulse **when** alarm 1	Relay pulses on when there is an alarm 1 condition for sensor. Uses pulse duration setting. (Alarm 1 condition configured on sensor tab)
	pulse **when** alarm 2	Relay pulses on when there is an alarm 2 condition for sensor. Uses pulse duration setting. (Alarm 2 condition configured on sensor tab)
	pulse **when** alarm 1 or alarm 2	Relay pulses on when there is either an alarm 1 or alarm 2 condition for sensor. Uses pulse duration setting. (Alarm conditions configured on sensor tab)
Relay	no action **when** relay on	Control relay has no effect on relay
	no action **when** relay off	Control relay has no effect on relay
	no action **when** relay changes	Control relay has no effect on relay
	turn on **when** relay on	Relay turns on when control relay turns on. Relay turns off when control relay turns off.
	turn on **when** relay off	Relay turns off when control relay turns on. Relay turns on when control relay turns off.
	turn on **when** relay changes	Relay turns on when control relay changes state. Control relay change does not turn relay back off.
	turn off **when** relay on	Relay turns off when control relay turns on. Relay turns on when control relay turns off.
	turn off **when** relay off	Relay turns off when control relay turns off. Relay turns on when control relay turns on.
	turn off **when** relay changes	Relay turns off when control relay changes state. Control relay change does not turn relay back on.

	latch on **when** relay on	Relay turns on when control relay turns on. Once on, the relay can only be turned off through other means. (Control page, modbus, etc.)
	latch on **when** relay off	Relay turns on when control relay turns off. Once off, the relay can only be turned on through other means. (Control page, modbus, etc.)
	latch on **when** relay changes	Relay turns on when control relay changes state. Once off, the relay can only be turned on through other means. (Control page, modbus, etc.)
	latch off **when** relay on	Relay turns off when control relay turns on. Once off, the relay can only be turned on through other means. (Control page, modbus, etc.)
	latch off **when** relay off	Relay turns off when control relay turns off. Once off, the relay can only be turned on through other means. (Control page, modbus, etc.)
	latch off **when** relay changes	Relay turns on when control relay changes state. Once off, the relay can only be turned on through other means. (Control page, modbus, etc.)
	toggle **when** relay on	Relay toggles state when control relay turns on. Relay maintains current state when control relay turns off.
	toggle **when** relay off	Relay toggles state when control relay turns off. Relay maintains current state when control relay turns on.
	toggle **when** relay changes	Relay toggles state when control relay turns off. Relay toggles state when control relay turns on.
	pulse **when** relay on	Relay pulses on when control relay turns on. Uses pulse duration setting.
	pulse **when** relay off	Relay pulses on when control relay turns off. Uses pulse duration setting.
	pulse **when** relay changes	Relay pulses on when control relay changes state. Uses pulse duration setting.

2.5.6 Remote Relays Tab

X-332 can be configured to control relays on other ControlByWeb devices across the network. These relays are called remote relays.

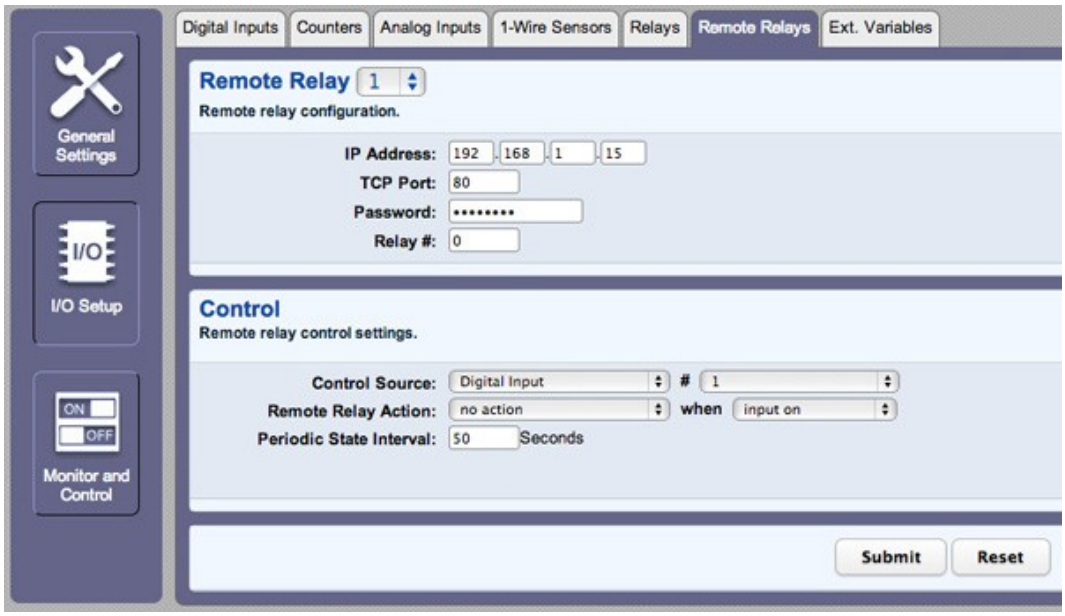


Figure 2.5h - Remote Relays Tab

Remote Relay

This option allows you to select which remote relay to configure.

IP Address

The IP address of the remote relay is entered here. The default value is `192.168.1.15`

TCP Port

The TCP port number used to access the remote relay is entered here. This must match the TCP port (HTTP port) set in the remote relay. The valid range is `0` to `65530`. The default port number is `80`

Password

If the remote relay requires a password for control, the password must be entered here

Relay #

The remote relay device may have multiple relays. This field is used to identify the specific relay to be controlled on a remote device. If the remote device is a single WebRelay™, this field should be zero. If the remote device has multiple relays, this field should be set to the relay number. For example if relay 2 is to be controlled on another ControlByWeb™ product, the Relay # would be set to 2. This field by be set from 0 to 16.

Control Source and #

These drop down menus specify what input/sensor/relay controls the state of the remote relay. The following options can be selected:

- ***Digital Input:*** The state of the remote relay will be controlled by a digital input.
- ***Analog Input:*** The state of the remote relay will be controlled by an analog input.
- ***1-Wire Sensor*****:** The state of the remote relay will be controlled by a 1-Wire Sensor (temperature or humidity)
- ***Relay*****:** The state of the remote relay will be controlled by the state of another relay.

Depending on the Control Source selected, the # drop down menu will change. For example, when Digital Input is selected, the # drop down menu will have options 1-18. If an analog input is selected, the # drop down menu will have options 1-4. If a Relay control source is selected then the # drop down menu will have options 1-16.

Relay Action – when –

These drop down menus specify what action to take when a criteria is met. The available actions are the same regardless of the control source. The criteria change depending on what control source has been selected. The following table details the options available based on the control source selected.

Control Source	Available Options	Description
Digital Input	no action **when** input on	Input has no effect on remote relay
	no action **when** input off	Input has no effect on remote relay
	no action **when** input changes	Input has no effect on remote relay
	turn on **when** input on	Remote relay turns on when input turns on. Remote relay turns off when input turns off.
	turn on **when** input off	Remote relay turns off when input turns on. Remote relay turns on when input turns off.
	turn on **when** input changes	Remote relay turns on when input changes state. Input change does not turn remote relay back off.
	turn off **when** input on	Remote relay turns off when input turns on. Remote relay turns on when input turns off.
	turn off **when** input off	Remote relay turns off when input turns off. Remote relay turns on when input turns on.
	turn off **when** input changes	Remote relay turns off when input changes state. Input change does not turn remote relay back on.
	latch on **when** input on	Remote relay turns on when input turns on. Once on, the remote relay can only be turned off through other means. (Control page, modbus, etc.)
	latch on **when** input off	Remote relay turns on when input turns off. Once off, the remote relay can only be turned on through other means. (Control page, modbus, etc.)
	latch on **when** input changes	Remote relay turns on when input changes state. Once off, the remote relay can only be turned on through other means. (Control page, modbus, etc.)
	latch off **when** input on	Remote relay turns off when input turns on. Once off, the remote relay can only be turned on through other means. (Control page, modbus, etc.)
	latch off **when** input off	Remote relay turns off when input turns off. Once off, the remote relay can only be turned on through other means. (Control page, modbus, etc.)
	latch off **when** input changes	Remote relay turns on when input changes state. Once off, the remote relay can only be turned on through other means. (Control page, modbus, etc.)
	toggle **when** input on	Remote relay toggles state when input turns on. Remote relay maintains current state when input turns off.
	toggle **when** input off	Remote relay toggles state when input turns off. Remote relay maintains current state when input turns on.
	toggle **when** input changes	Remote relay toggles state when input turns off. Remote relay toggles state when input turns on.
	pulse **when** input on	Remote relay pulses on when input turns on. Uses pulse duration setting on remote device.

	pulse **when** input off	Remote relay pulses on when input turns off. Uses pulse duration setting on remote device.
	pulse **when** input changes	Remote relay pulses on when input changes state. Uses pulse duration setting on remote device.
	pulse (heartbeat mode) **when** input on	Remote relay pulses on when input turns on and continues to pulse on periodically (periodic state interval) until the input turns off at which point the remote relay turns off. Uses pulse duration setting of remote device.
	pulse (heartbeat mode) **when** input off	Remote relay pulses on when input turns off and continues to pulse on periodically (periodic state interval) until the input turns on at which point the remote relay turns off. Uses pulse duration setting of remote device.
	pulse (heartbeat mode) **when** input changes	Remote relay pulses on when input changes state and continues to pulse on periodically (periodic state interval). Uses pulse duration setting of remote device.
Analog Input/ 1-Wire Sensors	no action **when** alarm 1	Sensor has no effect on remote relay.
	no action **when** alarm 2	Sensor has no effect on remote relay.
	no action **when** alarm 1 or alarm 2	Sensor has no effect on remote relay.
	turn on **when** alarm 1	Remote relay turns on when there is an alarm 1 condition for sensor. Remote relay turns off when there is no alarm 1 condition. (Alarm 1 condition configured on sensor tab)
	turn on **when** alarm 2	Remote relay turns on when there is an alarm 2 condition for sensor. Remote relay turns off when there is no alarm 2 condition. (Alarm 2 condition configured on sensor tab)
	turn on **when** alarm 1 or alarm 2	Remote relay turns on when there is either an alarm 1 or alarm 2 condition for sensor. Remote relay turns off when there is no alarm 1 or alarm 2 condition. (Alarm conditions configured on sensor tab)
	turn off **when** alarm 1	Remote relay turns off when there is an alarm 1 condition for sensor. Remote relay turns on when there is no alarm 1 condition. (Alarm 1 condition configured on sensor tab)
	turn off **when** alarm 2	Remote relay turns off when there is an alarm 2 condition for sensor. Remote relay turns on when there is no alarm 2 condition. (Alarm 2 condition configured on sensor tab)
	turn off **when** alarm 1 or alarm 2	Remote relay turns of when there is either an alarm 1 or alarm 2 condition for sensor. Remote relay turns on when there is no alarm 1 or alarm 2 condition. (Alarm conditions configured on sensor tab)

	latch on **when** alarm 1	Remote relay turns on when there is an alarm 1 condition for sensor. Once on, the remote relay stays on until reset by other means. (Alarm 1 condition configured on sensor tab)
	latch on **when** alarm 2	Remote relay turns on when there is an alarm 2 condition for sensor. Once on, the remote relay stays on until reset by other means. (Alarm 2 condition configured on sensor tab)
	latch on **when** alarm 1 or alarm 2	Remote relay turns on when there is either an alarm 1 or alarm 2 condition for sensor. Once on, the remote relay stays on until reset by other means. (Alarm conditions configured on sensor tab)
	latch off **when** alarm 1	Remote relay turns off when there is an alarm 1 condition for sensor. Once off, the remote relay stays off until reset by other means. (Alarm 1 condition configured on sensor tab)
	latch off **when** alarm 2	Remote relay turns off when there is an alarm 2 condition for sensor. Once off, the remote relay stays off until reset by other means. (Alarm 2 condition configured on sensor tab)
	latch off **when** alarm 1 or alarm 2	Remote relay turns of when there is either an alarm 1 or alarm 2 condition for sensor. Once off, the remote relay stays off until reset by other means. (Alarm conditions configured on sensor tab)
	toggle **when** alarm 1	Remote relay toggles state when there is an alarm 1 condition for sensor. (Alarm 1 condition configured on sensor tab)
	toggle **when** alarm 2	Remote relay toggles state when there is an alarm 2 condition for sensor. (Alarm 2 condition configured on sensor tab)
	toggle **when** alarm 1 or alarm 2	Remote relay toggles state when there is either an alarm 1 or alarm 2 condition for sensor. (Alarm conditions configured on sensor tab)
	pulse **when** alarm 1	Remote relay pulses on when there is an alarm 1 condition for sensor. Uses pulse duration setting of remote device. (Alarm 1 condition configured on sensor tab)
	pulse **when** alarm 2	Remote relay pulses on when there is an alarm 2 condition for sensor. Uses pulse duration setting of remote device (Alarm 2 condition configured on sensor tab)
	pulse **when** alarm 1 or alarm 2	Remote relay pulses on when there is either an alarm 1 or alarm 2 condition for sensor. Uses pulse duration setting of remote device. (Alarm conditions configured on sensor tab)
	pulse (heartbeat mode) **when** alarm 1	Remote relay pulses on when alarm 1 condition occurs and continues to pulse on periodically (periodic state interval) until the alarm condition clears at which point the remote relay turns off. Uses

		pulse duration setting of remote device.
	pulse (heartbeat mode) **when** alarm 2	Remote relay pulses on when alarm 2 condition occurs and continues to pulse on periodically (periodic state interval) until the alarm condition clears at which point the remote relay turns off. Uses pulse duration setting of remote device.
	pulse (heartbeat mode) **when** alarm 1 or alarm 2	Remote relay pulses on when alarm 1 or alarm 2 condition occurs and continues to pulse on periodically (periodic state interval) until the alarm condition clears at which point the remote relay turns off. Uses pulse duration setting of remote device.
Relay	no action **when** relay on	Control relay has no effect on remote relay
	no action **when** relay off	Control relay has no effect on remote relay
	no action **when** relay changes	Control relay has no effect on remote relay
	turn on **when** relay on	Remote relay turns on when control relay turns on. Remote relay turns off when control relay turns off.
	turn on **when** relay off	Remote relay turns off when control relay turns on. Remote relay turns on when control relay turns off.
	turn on **when** relay changes	Remote relay turns on when control relay changes state. Control relay change does not turn remote relay back off.
	turn off **when** relay on	Remote relay turns off when control relay turns on. Remote relay turns on when control relay turns off.
	turn off **when** relay off	Remote relay turns off when control relay turns off. Remote relay turns on when control relay turns on.
	turn off **when** relay changes	Remote relay turns off when control relay changes state. Control relay change does not turn remote relay back on.
	latch on **when** relay on	Remote relay turns on when control relay turns on. Once on, the remote relay can only be turned off through other means. (Control page, modbus, etc.)
	latch on **when** relay off	Remote relay turns on when control relay turns off. Once off, the remote relay can only be turned on through other means. (Control page, modbus, etc.)
	latch on **when** relay changes	Remote relay turns on when control relay changes state. Once off, the remote relay can only be turned on through other means. (Control page, modbus, etc.)
	latch off **when** relay on	Remote relay turns off when control relay turns on. Once off, the remote relay can only be turned on through other means. (Control page, modbus, etc.)
	latch off **when** relay off	Remote relay turns off when control relay turns off. Once off, the remote relay can only be turned on through other means. (Control page, modbus, etc.)

	latch off **when** relay changes	Remote relay turns on when control relay changes state. Once off, the remote relay can only be turned on through other means. (Control page, modbus, etc.)
	toggle **when** relay on	Remote relay toggles state when control relay turns on. Remote relay maintains current state when control relay turns off.
	toggle **when** relay off	Remote relay toggles state when control relay turns off. Remote relay maintains current state when control relay turns on.
	toggle **when** relay changes	Remote relay toggles state when control relay turns off. Remote relay toggles state when control relay turns on.
	pulse **when** relay on	Remote relay pulses on when control relay turns on. Uses pulse duration setting of remote device.
	pulse **when** relay off	Remote relay pulses on when control relay turns off. Uses pulse duration setting of remote device.
	pulse **when** relay changes	Remote relay pulses on when control relay changes state. Uses pulse duration setting of remote device.
	pulse (heartbeat mode) **when** relay on	Remote relay pulses on when control relay turns on and continues to pulse on periodically (periodic state interval) until the control relay turns off at which point the remote relay turns off. Uses pulse duration setting of remote device.
	pulse (heartbeat mode) **when** relay off	Remote relay pulses on when control relay turns off and continues to pulse on periodically (periodic state interval) until the control relay turns on at which point the remote relay turns off. Uses pulse duration setting of remote device.
	pulse (heartbeat mode) **when** relay changes	Remote relay pulses on when control relay changes state and continues to pulse on periodically (periodic state interval). Uses pulse duration setting of remote device.

Periodic State Interval

When the X-332™ is configured to control a remote device, a connection is established. If the device does not receive a message for 50 seconds, the connection is terminated. In order for the connection to be maintained, a message containing the state of the relay can be sent at a periodic interval. This field sets the time interval at which the message is sent. This field may be set from `0-50` seconds.The default setting is `50` seconds, which is the maximum time limit. If a connection should not be maintained enter a value of `0`.

2.5.7 External Variables

External Variables are variables that can be used in BASIC scripts. They are called External Variables because their values can be changed externally to the BASIC script using XML requests, or through the **Control Page**. This allows basic scripts to react to user input. These variables are considered to be floating point numbers, just like other variables in the BASIC script.

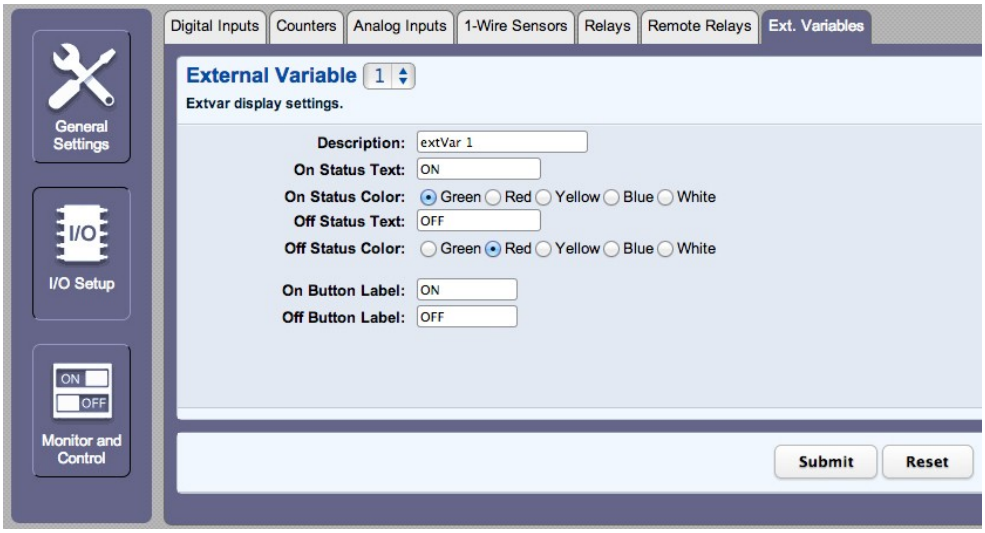


Figure 2.5i - ExtVar Configuration

External Variable

This drop down menu selects the External Variable to configure.

Description

Text entered here will be displayed in the left column of the control page. Up to 12 characters may be entered here. The default text is `extVar #`.

On Status Text

The text in this field specifies the text that will be displayed when the extVar is value 1. The text also appears in the status column on the **Control Page**. Up to 10 characters may be entered here. By default the text is `ON`.

On Status Color

This field specifies the color that will be displayed on the control page when the extVar is considered On. Options are Green, Red, Yellow, Blue and White. The default color is Green.

Off Status Text

The text in this field specifies the text that will be displayed when the extVar is value 0. The text also appears in the status column on the **Control Page**.
If the extVar is any other value than 1 or 0, the value will be displayed in the same column. Up to 10 characters may be entered here. By default the text is `OFF`.

Off Status Color

This field specifies the color that will be displayed on the control page when the extVar is considered Off. Options are Green, Red, Yellow, Blue and White. The default color is Red.

On Button Label

This text field is used to describe the function of button 1 of the selected extVar. The text also appears to the right of the corresponding extVar status. Up to 8 characters may be entered here. By default, this text is `ON`.

Off Button Label

This text field is used to describe the function of button 2 of the selected extVar. The text also appears to the right of the corresponding extVar status. Up to 8 characters may be entered here. By default, this text is `OFF`.

2.6 X-332™ Monitor and Control Pages

X-332™ can be monitored and controlled many different ways. The most direct way is through the Monitor and Control pages. To access the Monitor and Control pages enter the following address into the address bar of the web browser:

```
http://{ipaddress}/setup.html
```

For example, using the default IP address, enter:

http://192.168.1.2/setup.html

To access the Monitor and Control pages choose Monitor and Control on the menu bar on the left side of the setup screen.

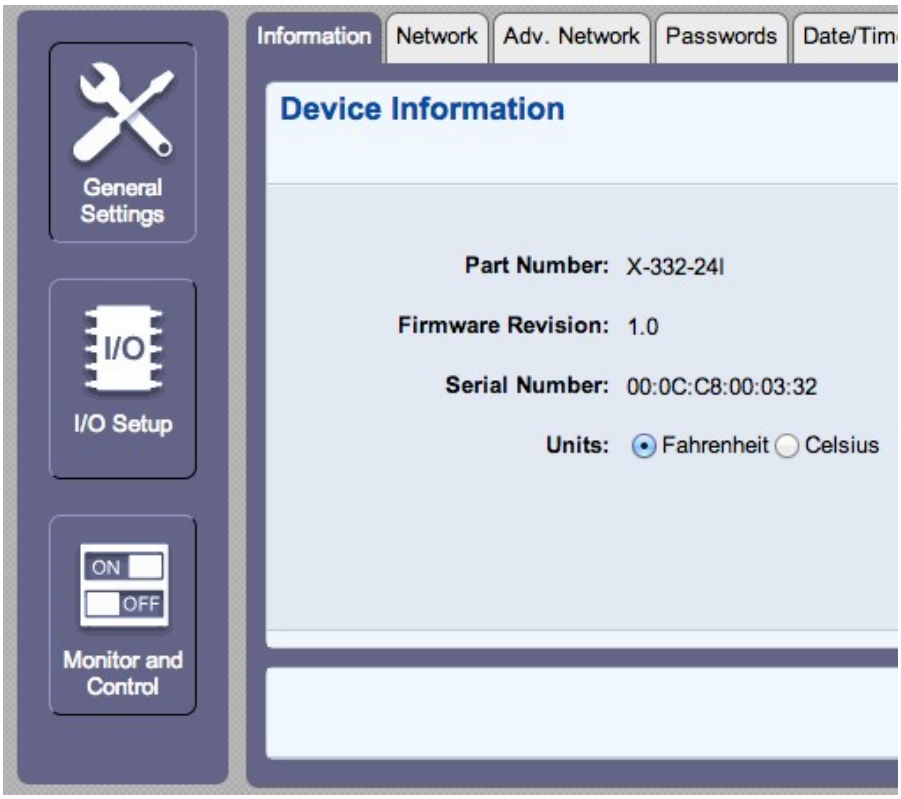


Figure 2.6a - Main Tab

2.6.1 Control Page Tab

The Control Page displays the current state of the X-332™ and presents buttons that can be used to control the relays of the device. A more detailed explanation of this page can be found in section 3.1 Browser Operation.

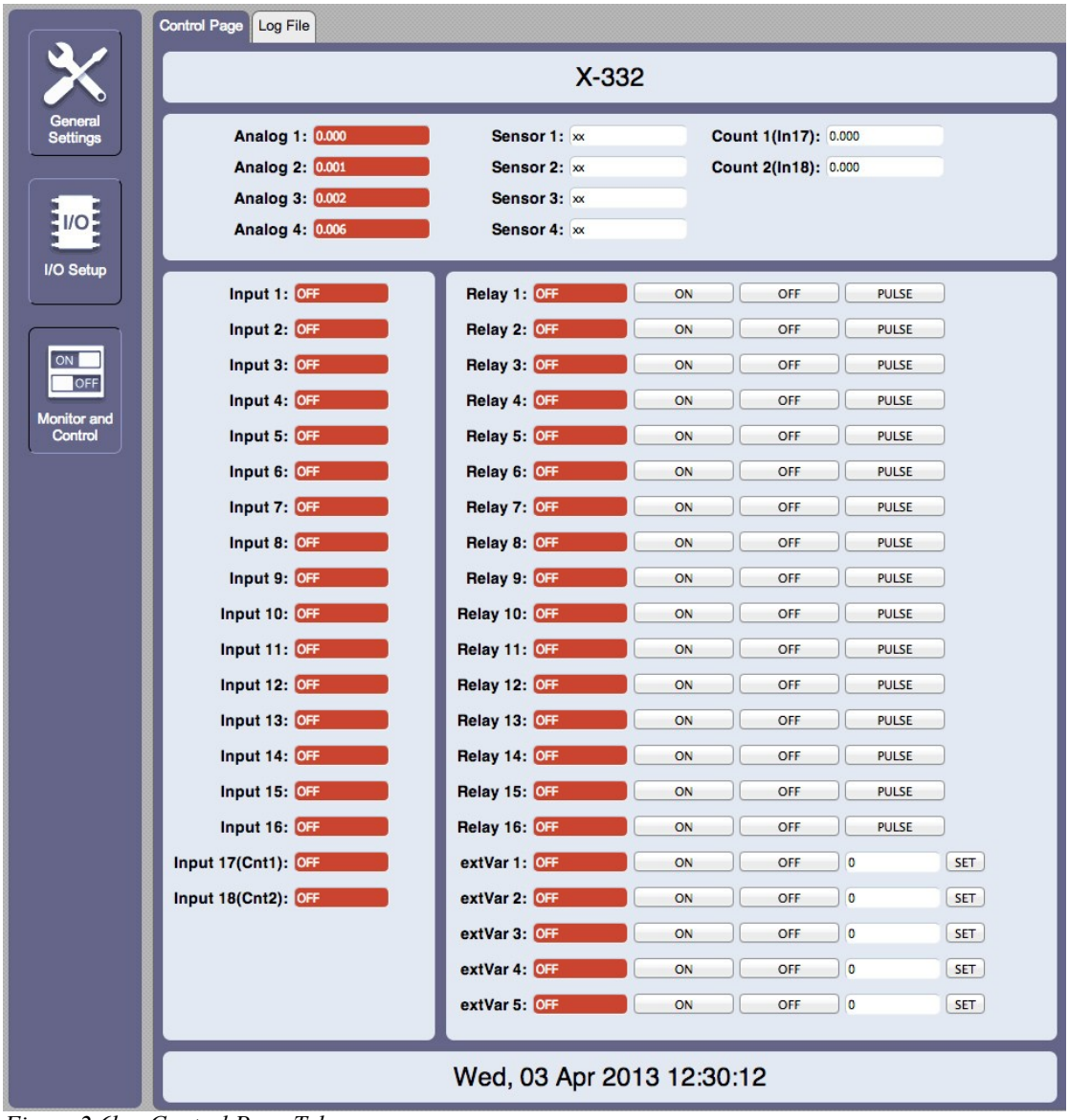

Control Page
Log File
General Settings
I/O Setup
Monitor and Control
X-332
Analog 1: 0.000
Analog 2: 0.001
Analog 3: 0.002
Analog 4: 0.006
Sensor 1: xx
Sensor 2: xx
Sensor 3: xx
Sensor 4: xx
Count 1(In17): 0.000
Count 2(In18): 0.000
Input 1: OFF
Input 2: OFF
Input 3: OFF
Input 4: OFF
Input 5: OFF
Input 6: OFF
Input 7: OFF
Input 8: OFF
Input 9: OFF
Input 10: OFF
Input 11: OFF
Input 12: OFF
Input 13: OFF
Input 14: OFF
Input 15: OFF
Input 16: OFF
Input 17(Cnt1): OFF
Input 18(Cnt2): OFF
Relay 1: OFF ON OFF PULSE
Relay 2: OFF ON OFF PULSE
Relay 3: OFF ON OFF PULSE
Relay 4: OFF ON OFF PULSE
Relay 5: OFF ON OFF PULSE
Relay 6: OFF ON OFF PULSE
Relay 7: OFF ON OFF PULSE
Relay 8: OFF ON OFF PULSE
Relay 9: OFF ON OFF PULSE
Relay 10: OFF ON OFF PULSE
Relay 11: OFF ON OFF PULSE
Relay 12: OFF ON OFF PULSE
Relay 13: OFF ON OFF PULSE
Relay 14: OFF ON OFF PULSE
Relay 15: OFF ON OFF PULSE
Relay 16: OFF ON OFF PULSE
extVar 1: OFF ON OFF 0 SET
extVar 2: OFF ON OFF 0 SET
extVar 3: OFF ON OFF 0 SET
extVar 4: OFF ON OFF 0 SET
extVar 5: OFF ON OFF 0 SET
Wed, 03 Apr 2013 12:30:12

Figure 2.6b – Control Page Tab

2.6.2 Log File Tab

The Log File Tab shows a formatted version of the log file when logging has been enabled on the Logging setup tab. This contains the same information found when the log.txt file is requested from the device. More details about the log.txt file can be found in Appendix D.

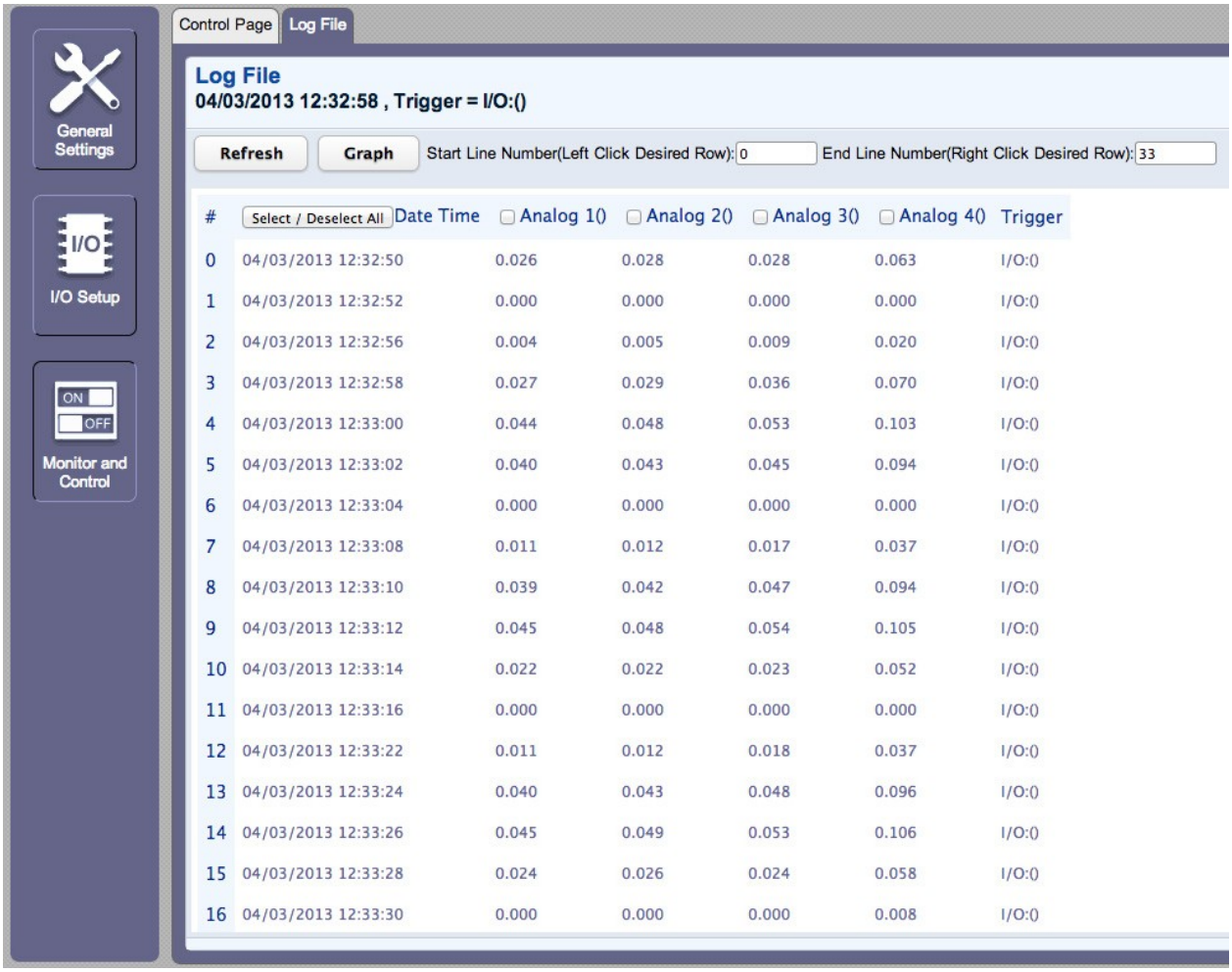


Figure 2.6c – Log File Tab

At the top of the Log File page are two buttons. The first button will update the displayed log file from the X-332™. It has the same function as navigating to the Log File tab for the first time. Depending on the size of the log file, it can take some time for the log file to be fully loaded and formatted.

The next button is the Graph button. This button will open a popup window that displays a graph of the log file. The check boxes at the top of the log file data determine what items are graphed. For larger log files, portions of the log file may be chosen to graph. Left clicking on the log data will choose a starting row for the graph, and right clicking on the log data will choose a ending row.

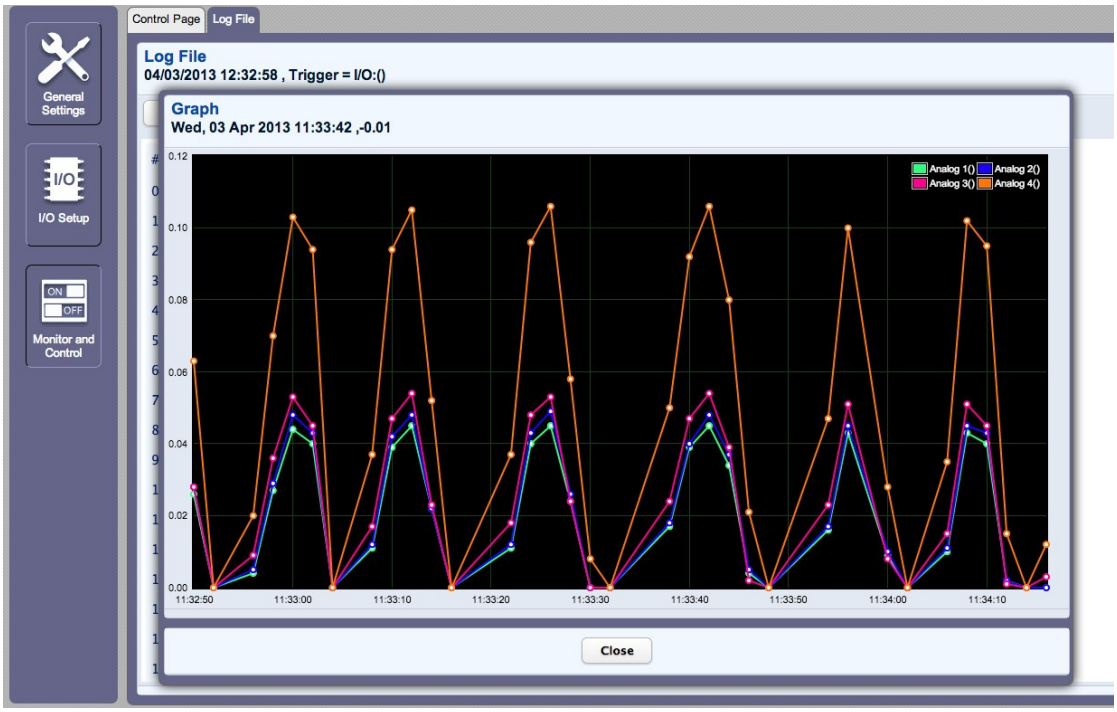


Figure 2.6d – Graph

Specific values can be found in the graph by hovering the mouse cursor over the graphed data. The time and value for the location beneath the mouse cursor will appear in the top left corner of the graph popup window. The graph's Key appears in the top right of the graph.

Left clicking on the graph and dragging the mouse to the right or left will select a portion of the graph to zoom in on.

If more complex analysis of the logged data is required, a comma separated text file can be downloaded and used with a graphing/spreadsheet program. For more details refer to Appendix D.

Section 3: Operation

X-332™ can be operated using a web browser, by sending text commands to an XML status/control page, and/or by sending Modbus/TCP requests. X-332™ also allows you to control the relays using inputs, sensors, other relays, or events. (Using an input or event to control the relays was described throughout previous sections of the manual, and will not be described here.)

3.1 Browser Operation

Once the X-332™ is set up, users can access the Control Page using a web browser. There are a couple of ways to do this. The first is by typing the IP address of X-332™ directly into the web browser address bar. For example, using the default IP address, the user would enter http://192.168.1.2. If the IP address is changed from the default, the user must use the new IP address. Note that if any port is used other than the default port 80, the port must also be included in the request. For example, accessing the unit at port 8000 would be as follows: http://192.168.1.2:8000.

The following screen appears when the Control Page is requested from the address bar:

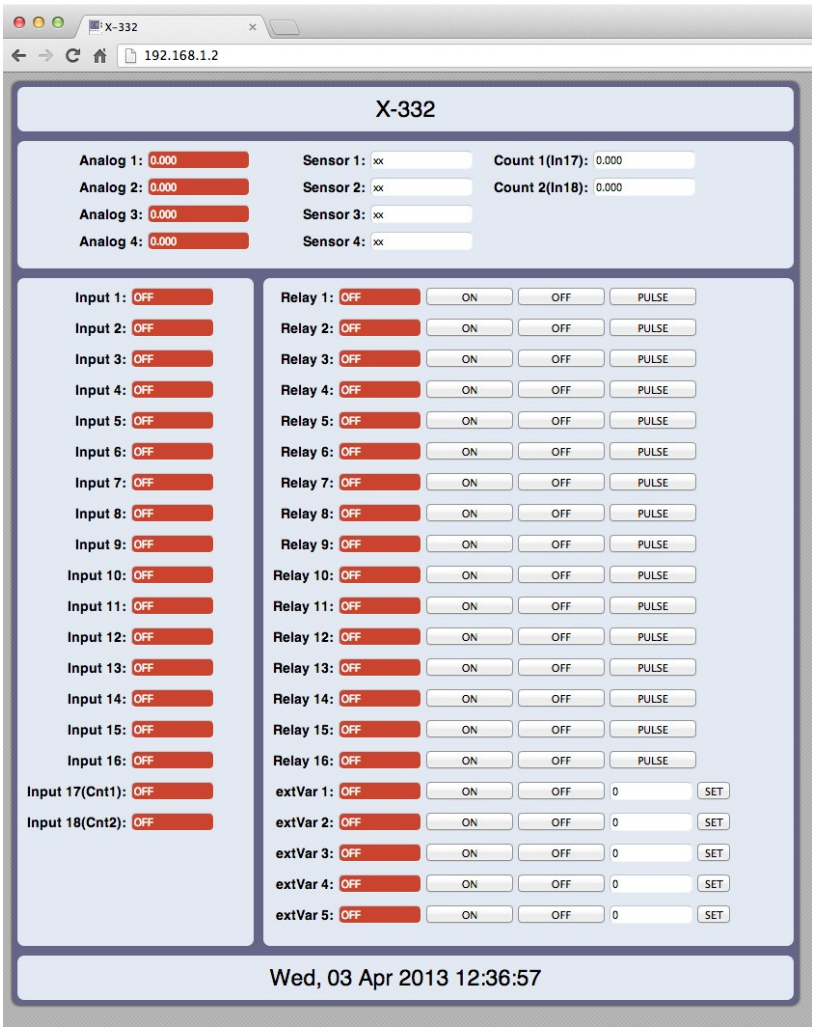

X-332
192.168.1.2
X-332
Analog 1: 0.000
Analog 2: 0.000
Analog 3: 0.000
Analog 4: 0.000
Sensor 1: xx
Sensor 2: xx
Sensor 3: xx
Sensor 4: xx
Count 1(In17): 0.000
Count 2(In18): 0.000
Input 1: OFF
Input 2: OFF
Input 3: OFF
Input 4: OFF
Input 5: OFF
Input 6: OFF
Input 7: OFF
Input 8: OFF
Input 9: OFF
Input 10: OFF
Input 11: OFF
Input 12: OFF
Input 13: OFF
Input 14: OFF
Input 15: OFF
Input 16: OFF
Input 17(Cnt1): OFF
Input 18(Cnt2): OFF
Relay 1: OFF ON OFF PULSE
Relay 2: OFF ON OFF PULSE
Relay 3: OFF ON OFF PULSE
Relay 4: OFF ON OFF PULSE
Relay 5: OFF ON OFF PULSE
Relay 6: OFF ON OFF PULSE
Relay 7: OFF ON OFF PULSE
Relay 8: OFF ON OFF PULSE
Relay 9: OFF ON OFF PULSE
Relay 10: OFF ON OFF PULSE
Relay 11: OFF ON OFF PULSE
Relay 12: OFF ON OFF PULSE
Relay 13: OFF ON OFF PULSE
Relay 14: OFF ON OFF PULSE
Relay 15: OFF ON OFF PULSE
Relay 16: OFF ON OFF PULSE
extVar 1: OFF ON OFF 0 SET
extVar 2: OFF ON OFF 0 SET
extVar 3: OFF ON OFF 0 SET
extVar 4: OFF ON OFF 0 SET
extVar 5: OFF ON OFF 0 SET
Wed, 03 Apr 2013 12:36:57

Figure 3.1a - Control Page – Everything displayed

The second method of accessing the control page is through the setup pages (http://192.168.1.2/setup.html). Choosing the 'Monitor and Control' button on the left hand side of the setup pages will bring up the control page shown below. From here the log file can be viewed as well by selecting the 'Log File' tab at the top. The log file will be explained in more detail in the next section.

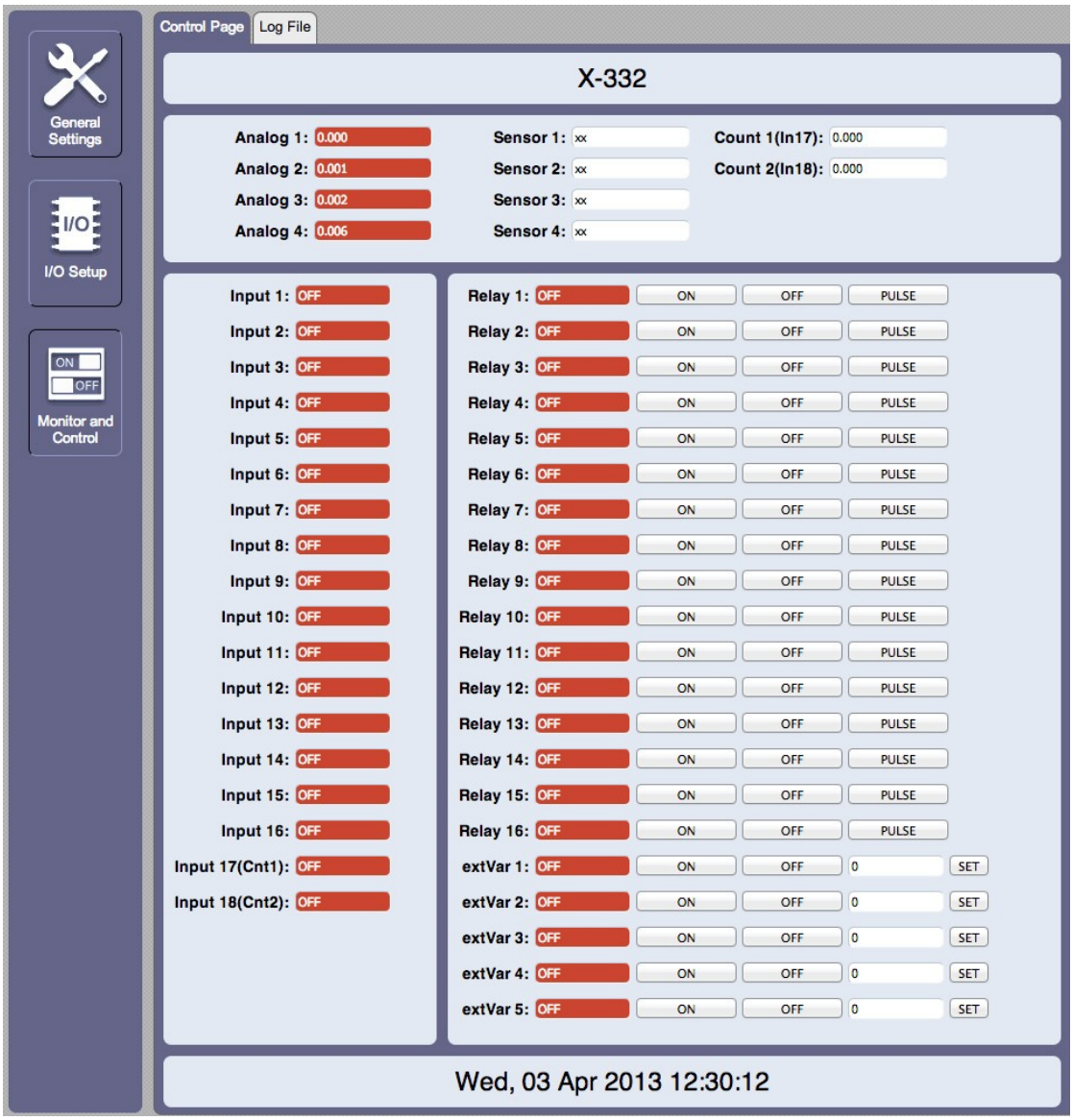

Control Page
Log File
General Settings
I/O Setup
Monitor and Control
X-332
Analog 1: 0.000
Analog 2: 0.001
Analog 3: 0.002
Analog 4: 0.006
Sensor 1: xx
Sensor 2: xx
Sensor 3: xx
Sensor 4: xx
Count 1(In17): 0.000
Count 2(In18): 0.000
Input 1: OFF
Input 2: OFF
Input 3: OFF
Input 4: OFF
Input 5: OFF
Input 6: OFF
Input 7: OFF
Input 8: OFF
Input 9: OFF
Input 10: OFF
Input 11: OFF
Input 12: OFF
Input 13: OFF
Input 14: OFF
Input 15: OFF
Input 16: OFF
Input 17(Cnt1): OFF
Input 18(Cnt2): OFF
Relay 1: OFF ON OFF PULSE
Relay 2: OFF ON OFF PULSE
Relay 3: OFF ON OFF PULSE
Relay 4: OFF ON OFF PULSE
Relay 5: OFF ON OFF PULSE
Relay 6: OFF ON OFF PULSE
Relay 7: OFF ON OFF PULSE
Relay 8: OFF ON OFF PULSE
Relay 9: OFF ON OFF PULSE
Relay 10: OFF ON OFF PULSE
Relay 11: OFF ON OFF PULSE
Relay 12: OFF ON OFF PULSE
Relay 13: OFF ON OFF PULSE
Relay 14: OFF ON OFF PULSE
Relay 15: OFF ON OFF PULSE
Relay 16: OFF ON OFF PULSE
extVar 1: OFF ON OFF 0 SET
extVar 2: OFF ON OFF 0 SET
extVar 3: OFF ON OFF 0 SET
extVar 4: OFF ON OFF 0 SET
extVar 5: OFF ON OFF 0 SET
Wed, 03 Apr 2013 12:30:12

Figure 3.1b - Control Page Through the Setup Pages Menu – Everything displayed

The following fields are found on the control page:

Header

Displays the text entered in the Main Header Text field on the **Control Page Setup** tab in the setup pages.

Analog Inputs

These fields displays the current analog input measurements. Each analog inputcan be displayed (as shown) or not displayed by checking or clearing the appropriate boxes under the **Control Page Setup** tab in the setup pages. The analog inputdescriptions (by default reads Analog 1 through Analog 4), is specified in the Analog Description field under the **Analog Inputs** tab in the setup pages.

Sensor 1-4

These fields display the current temperature or humidity measured by the associated sensors. Each sensor can be displayed (as shown) or not displayed by checking or clearing the appropriate boxes under the **Control Page Setup** tab in the setup pages. The sensor descriptions (by default reads Sensor 1 through Sensor 4), is specified in the Sensor Description field under the **Sensors** tab in the setup pages.

Count 1-2

A cumulative count of OFF to ON states of the digital inputs is displayed when the Display Counter box is checked.

Input 1 through 18

These rows display the current state of the sixteen optically-isolated inputs and the two counter inputs (inputs 17 and 18). Each of these rows can be displayed (as shown) or not displayed by checking or deselecting the appropriate boxes in the **Control Page Setup** tab in the setup pages. The text in the left column (by default reads Input 1, Input 2, etc,) is specified in the Description field in the **Input** tab in the setup pages.

Relay 1 through 16

These rows display the current state of the internal relays and allows the user to change relay state. Each of these rows can be displayed (as shown) or not displayed by checking or deselecting the appropriate boxes in the **Control Page Setup** tab in the setup pages. The text in the left column (by default reads Relay 1, Relay 2, etc,) is specified in the Description field in the **Relays** tab in the setup pages. The state of the relays is shown to the right of the relay description text. By default, the status text will read ON or OFF; however, the status text can be changed in the **Relays** tab. To the right of the relay status, buttons are provided to control the relays. The buttons can be removed when not needed (in the **Control Page Setup** tab) and the text within the buttons can be customized (in the **Relays** tab).

External Variables

These rows display the current state of the five external variables used in the BASIC script. These rows can be displayed (as shown in figure 3.1a) or not displayed (figure 3.1b) by checking or clearing the appropriate boxes in the extvar setup page.

The text in the left column is specified in the Description field on the extvar setup page. The state of the extvar is shown to the right of the description text. By default the status text will read ***ON*** or ***OFF*** when the extvar is a value of 1 or 0 respectively . To the right of the extvar status, on/off buttons and an input box are provided to control the state/value of the external variable. There is also an option to display up/down buttons that will increment/decrement the extvar when they are pressed or held down. All of these buttons can be enabled/disabled on the **Control Page Setup** tab.

More information on external variables can be found in **Appendix G: BASIC Scripts**.

Current Time

Displays the current time that is set using the **Date/Time** tab in the setup pages.

3.2 XML Operation

Custom XML computer applications may be created to monitor and control the X-332™. This method does not use a web browser. There are three XML pages that can be used to monitor and control the X-332™, state.xml, eventX.xml. and Diagnostics.xml.

Refer to **Appendix E: External Server and Remote Services** for more information on network configurations when using XML.

3.2.1 state.xml

XML Monitor All Functions

The state of the Relays, Digital Inputs, Counters, Sensors, and Analog Inputs can be monitored by sending a request to port 80 (or port specified in setup). This can be demonstrated by entering the following URL into the address bar of a web browser (substituting the IP address as necessary):

```
http://192.168.1.2/state.xml
```

The following state.xml page is returned:

```
<datavalues>
      <inputstates>0000000000000000</inputstates>
      <relaystates>0000000000000000</relaystates>
      <input3state>0</input3state>
      <an1state>0</an1state>
      <an2state>0</an2state>
      <an3state>0</an3state>
      <an4state>0</an4state>
      <an1Alrm>0</an1Alrm>
      <an2Alrm>0</an2Alrm>
      <an3Alrm>0</an3Alrm>
      <an4Alrm>0</an4Alrm>
      <sensor1>x.x</sensor1>
      <sensor2>x.x</sensor2>
      <sensor3>x.x</sensor3>
      <sensor4>x.x</sensor4>
      <sensor5>x.x</sensor5>
      <s1Alrm>2</s1Alrm>
      <s2Alrm>2</s2Alrm>
      <s3Alrm>2</s3Alrm>
      <s4Alrm>2</s4Alrm>
      <s5Alrm>2</s5Alrm>
      <count1>23</count1>
      <count2>23</count2>
      <extvar1>0.00</extvar1>
      <extvar2>0.00</extvar2>
      <extvar3>0.00</extvar3>
      <extvar4>0.00</extvar4>
      <extvar5>0.00</extvar5>
      <serialNumber>00:0C:C8:00:00:00</serialNumber>
      <time>1343647469</time>
</datavalues>
```

The numbers enclosed by the tags, `<tag>`, indicate the current state or value monitored by X-332™. Values for each tag are described in the table below.

XML computer applications will open a TCP/IP socket with the X-332™ and send a `GET` command followed by the state.xml command string. (See **Appendix E** for instructions on using GET.)

XML Tags*	Monitor Values
<inputstates>	0=off 1=on Inside this tag will be a 18 digit number. Each digit represents the state of one input. The leftmost digit represents input 18. The rightmost digit represents input 1.
<relaystates>	0=off (coil one off) 1=on (coil one energized) Inside this tage will be a 16 digit number. Each digit represents the state of one relay. The leftmost digit represents relay16. The rightmost digit represents relay1.
<anXstate>	Scaled analog measurement
<anXAlrm>	Current state of the analog alarm 0 = Normal 1 = Alarm 1 condition 2 = Alarm 2 condition
<sensorX>	x.x = Indicates that no digital temperature sensor is attached. 77.3 = Current temperature. H24.9 = Current humidity reading.
<sXAlrm>	Current state of the sensor alarms 0 = Normal 1 = Alarm 1 2 = Alarm 2
<countX>	The scaled count value (rawCount * multiplier + offset).
<extvarX>	Value of each External Variable.
<serialNumber>	00:00:00:00:00:00, serial number of X-332™.
<time>	Time displayed in “epoch time” (number of seconds since January 1, 1970)

* 'X' is replaced by the analog input or sensor number.

XML Control

Commands can be sent to the X-332™ to control the relays, counters, and external variables.

Relay State Control

Commands are sent using a variable called relayXState (X is replaced by 1 for relay 1, or 2 for relay 2, etc). A few examples of using relayXState are given here.

Command	Description
state.xml?relay1State=0	Turn Relay 1 *OFF*
state.xml?relay1State=1	Turn Relay 1 *ON*
state.xml?relay2State=0	Turn Relay 2 *OFF*
state.xml?relay2State=1	Turn Relay 2 *ON*

Pulse Relay

When the pulse command is sent, the output will turn ***ON*** for the Pulse Duration specified in the **Relay** setup page . It is also possible to send a pulse time command that is different than the configured Pulse Duration. This is done by sending a pulseTime variable. The pulseTime variable does not change the Pulse Duration in the setup page and it is not stored or recorded. The pulseTime variable only changes the duration for the single pulse initiated by that command. In other words, you must issue the

pulseTime command for each pulse command that differs from the preset value.
For example, if the X-332™ is configured for a Pulse Duration of 1.5 seconds. To issue one 1.5 second pulse, three 5 second pulses, and another 1.5 second pulse to relay 1, you would issue the following commands.

Command	Description
state.xml?relay1State=2	Pulse Relay 1 for the preset time (1.5 seconds).
state.xml?relay1State=2&pulseTime1=5	Pulse Relay 1 for 5 seconds.
state.xml?relay1State=2&pulseTime1=5	Pulse Relay 1 for 5 seconds.
state.xml?relay1State=2&pulseTime1=5	Pulse Relay 1 for 5 seconds.
state.xml?relay1State=2	Pulse Relay 1 for the preset time (1.5 seconds).

XML Set Counter

The counter value can be set using the `countx` command.

Command	Description
`state.xml?count1=200`	Set counter1 to 200.

Message Acknowledgment

By default, when commands are sent to X-332™, the state.xml page is returned. The xml reply can be disabled by adding the `noReply` field as follows:

Command	Description
`state.xml?relay1State=1&noReply=1`	Turn Relay 1 *ON* without returning state
`state.xml?relay1State=0&noReply=1`	Turn Relay 1 *OFF* without returning state

3.2.2 eventX.xml

The X-332™ can configure outputs to turn *ON, OFF*, or pulse at specific times. An event changes the output state at a given time (or periodically). The X-332™ supports 100 events, which can be monitored through the eventX.xml page (where X is the event number 0-99). For example, to access event 0's xml file in a web browser, you enter the following URL with the IP address of the X-332™.

`http://`**{X-332™ IP address}**`/event0.xml`

The following event.xml page is returned:

```
<event0>
      <active>yes</active>
      <currentTime>11/14/2010 15:14:09</currentTime>
      <nextEvent>11/15/2010 15:15:00</nextEvent>
      <period>1 d</period>
      <count>0</count>
      <relay>1</relay>
      <action>turn relay(s) on</action>
      <pulseDuration>0.5 s</pulseDuration>
</event0>
```

The tags used by X-332™ are described below:

Tags*	Description
<eventX>	Event tag where X represents the event number (0-99).
<active>	This field indicates whether or not the event is active. The text yes indicates that the event is active and the event will occur at the next event time. The text no indicates that the event is inactive and the event will no longer take place.
<currentTime>	This field indicates the current date and time as MM/DD/YYYY HH:MM:SS in 24-hour format.
<nextEvent>	The next time the event is scheduled to occur is given as MM/DD/YYYY HH:MM:SS. If an event is inactive, this field will display the date and time as xx/xx/xxxx xx:xx:xx.
<period>	For events that occur more than one time, this field indicates the period of the event (time between event occurrences). The unit of time is indicated after the value (seconds (s), minutes (m), hours (h), days (d), or weeks (w)). If this field is set to 0, then the event has been disabled. For example 1d would be a period of 3 days.
<count>	This field indicates the number of remaining times the event will occur. If this field is 0 and the event is active, then the event is always on.
<relay>	Event will apply to the relay(s) specified
<action>	One of the follow actions is applied to the event. turn relay(s) on turn relay(s) off pulse relay(s) toggle relay(s) set extVar0 clear extVar0 change schedules
<pulseDuration>	This field indicates the time (in seconds) that the output will be turned on.

- *'X' is replaced by the I/O number.*

3.2.3 Diagnostics.xml

There is a special diagnostics.xml that can be requested by by entering the following in the web browser address bar:

```
http://192.168.1.2/diagnostics.xml
```

The following diagnostics.xml file is returned.

```
<datavalues>
      <internalTemp>89.3</internalTemp>
      <memoryPowerUpFlag>1</memoryPowerUpFlag>
      <devicePowerUpFlag>1</devicePowerUpFlag>
      <powerLossCounter>1</powerLossCounter>
</datavalues>
```

Diagnostic tags are given in the following table:

Tag	Description
<internalTemp>	Indicates the internal temperature of the device.
<memoryPowerUpFlag>	Indicates a loss of power to the capacitor-backed real-time clock. A value of `1` indicates that the real-time clock lost power. This should only happen if the device has lost power for several days. There is an internal capacitor that can power the real-time clock for an extended period of time, even if the main power is lost. If the real-time-clock loses power, the time will have to be reset. By default, this will read `1` until it is set to `0`.
<devicePowerUpFlag>	Indicates a loss of power to the device. This field can also be set to `0`. A value of `1` means the X-332™ has lost power at least one time since the flag was set to `0`.
<powerLossCounter>	This field is a count of how many times the X-332™ has lost main power.

The above flags may be cleared by requesting the diagnostics.xml file along with request parameters. To clear the real-time clock power loss flag:

```
http://192.168.1.2/diagnostics.xml?memoryPowerUpFlag=0
```

To clear the device power loss flag:

```
http://192.168.1.2/diagnostics.xml?devicePowerUpFlag=0
```

To clear the powerLossCounter flag:

```
http://192.168.1.2/diagnostics.xml?powerLossCounter=0
```

Resetting of multiple flags may be done at one time by placing `&` between each request:

```
http://192.168.1.2/diagnostics.xml?memoryPowerUpFlag=0&devicePowerUpFlag=0
```

Note: Requests for the diagnostics.xml file do not require a password.

3.3 HTTP GET Requests (for custom applications)

Every X-332™ has a built in web server that responds to HTTP GET requests. These GET requests are sent from web browsers when a web page is requested. They are fairly similar to the actual addresses seen in the browser's address bar. The following section describes the HTTP GET protocol and how it can be used to control and monitor the X-332™.

3.3.1 Using GET for Control and Monitoring

No Password

GET requests to the device for XML files.

Example request state.xml:

```
GET /state.xml HTTP/1.1\r\n\r\n
```

Example turn Relay1 On:

```
GET /state.xml?relay1State=1\r\n\r\n
```

Password Enabled

If the Control Password is enabled on X-332™ and the state.xml page is requested through a browser, the user will be prompted for a password. If the XML request is sent from an XML application, the html request will need to contain the password, encoded as Base64.
The following is an html request header without the password:

```
GET /state.xml?relay1State=1&noReply=1 HTTP/1.1 (Terminated with two \r\n.)
```

The following example adds the password:

```
GET /state.xml?relay1State=1&noReply=1 HTTP/1.1 (Terminated with one \r\n.)
Authorization: Basic bm9uZTp3ZWJyZWxheQ== (Terminated with two \r\n.)
```

`bm9uZTp3ZWJyZWxheQ==` is the Base64 encoded version of the user “name:password,” `none:webrelay.`
A utility is provided at http://www.controlbyweb.com/encoder to encode the password. Simply type the string username:password into the website and press 'Encode'.

3.3.2 HTTP GET Event Configuration

Events can be configured using a GET request through http. For example, to configure event 5 to start on November 19, 2010 at 12:00:00 and continue every day, turning Output 1 on, send the following request (using the default IP address):

```
http://192.168.1.2/eventSetup.srv?
e5=1290168000;1;3;0;0;1;4;0;Event5Desc;127;1;
```

The basic format of the request is:

e(event#)=epoch time;period;period units;count;schedule#;action;pulse duration;0;description;days;action#;

Parameter	Description
e5=	**Parameter Name:** Each event has an identifier (0-99). In this case the parameter name is e5. Event 100 would be e99.
1290168000	**Epoch Time:** The number of seconds up to the desired start date since January 1, 1970.
1	**Period:** The period value.
3	**Period Units:** The units of the period, 0-Seconds, 1-Minutes, 2-Hours, 3-Days, 4-Weeks.
0	**Count:** Number of times the event will occur. (0 = continuous)
0	**Schedule #:** The schedule where the event will occur (0-4). 0 = schedule 0, 1= schedule 1, and so forth.
1	**Action:** 0-No Action, 1-Turn output on, 2-Turn output off, 3-Pulse output, 4-Toggle output, 5-change schedules, 7-Set extVar0, 8-Clear extVar0.
4	**Pulse Duration:** Pulse duration when using the pulse output action.
0	**Next Occurrence:** This is a report value only, indicating the next time this event will occur in Epoch Time. When setting an event leave this at 0.
Event5Desc;	**Description:** Text description of the event, up to 20 characters can be entered.
127	**Days:** This number represents which days the event will occur. This value is the base ten version of a binary number where each bit represents one day of the week. Bit 0 is Saturday and Bit 6 is Sunday. See the table below for some common values.
1	**Action #:** This number represents which output will be affected by the event. This value is the base ten version of a binary number where each bit represents the ***ON/OFF*** state of one output. Bit 0 corresponds to relay/schedule 1, and Bit 3 corresponds with relay/schedule 4.

3.3.3 Common Base Ten Values for Event Days

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Base 10 Value
Bit 6	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	--
1	1	1	1	1	1	1	**127**
0	1	1	1	1	1	0	**62**
0	1	0	1	0	1	0	**42**
0	0	1	0	1	0	0	**20**
0	0	0	0	0	0	1	**1**

3.4 Modbus Operation

X-332™ can be controlled and monitored using Modbus/TCP protocol. This provides a standard means of using X-332™ with devices and software from other manufacturers. This section is not a tutorial on Modbus and it is assumed that the reader is already familiar with Modbus. Detailed Modbus information can be found at http://www.modbus.org.

Note: Modbus communications are disabled whenever the Control Password is enabled. This is because Modbus/TCP does not provide a mechanism for password protection. Make sure the Control Password is disabled (default) and Modbus functionality is enabled on the Advanced Network tab (General Settings).

X-332™ functions as a Modbus slave. Host devices, such as PLCs, open a connection with X-332™ on port 502 (configurable under **Advanced Network** tab) and then send requests to read or set relay states, read input states, or sensor values. When X-332™ receives a command, it will perform the desired function and return a response.

The following sections provide an overview and explanation of Modbus operation. **Appendix H: Modbus Details** provides further packet and protocol information.

3.4.1 X-332™ Function Code Summary

X-332™ supports the following function codes:

Code Name	Modbus Function	X-332 Feature	X-332 Start Address	
			Hexadecimal	Decimal
Read Coils	01	Relays 1-16	0x0000-0x000F	0-15
Read Discrete Inputs	02	Inputs 1-18	0x0000-0x0011	0-17
Read Analog Inputs	03	Analog Inputs 1-4	0x0010-0x0017	16-23
Read Sensors	03	Sensors 1-4	0x0110-0x0116	272-278
Read Counters	03	Counters 1-2	0x0210-0x0212	528-530
Write Single Coil	05	Relay 1-16	0x0000-0x000F	0-15
Write Multiple Coils	15	Relay 1-16	0x0000-0x000F	0-15
Pulse Coils	16	Relay 1-16	0x0310-0x032F	784-815
Set Counter	16	Counters 1-2	0x0210-0x0211	528-530

Multiple commands may be sent without closing and re-opening the connection, but if no data is transferred for 50 seconds, the connection will time out and close. To keep the connection open, a read request can be sent periodically.

X-332™ has two TCP sockets available for Modbus/TCP. This allows two connections to be open at one time. Requests for more than two open connections will be rejected.

When errors occur, an error code is returned. Most Modbus client software will interpret this code in a human readable form. The code is comprised of the original function code plus 0x80. For example, an error during the read coils function 0x01 would return 0x81. Each error has a qualifying exception number. The following are the possible exception codes and their meanings:

0x01 - Function code not supported (also when Modbus is disabled in the setup pages).
0x02 - Incorrect starting address/quantity of output combination.

3.4.2 PLC Device Addressing

There are generally two schemes for accessing Modbus devices, the first is by specifying the Modbus function code, memory type, and address. The second, sometimes called PLC addressing, requires only the address.
Modbus protocol uses four different address ranges for discrete inputs, coils, input registers, and holding registers. The function code determines the address range of the message. The following are common function codes and their respective address ranges.

Code Name	Modbus Function	Data Type*	PLC Address Mode 485	PLC Address Mode 584/984
Coils (Read/Write)	01, 05, 15	Discrete	1-1000	1-10000
Discrete Inputs (Read only)	02	Discrete	1001-2000	10001-20000
Registers (Read only)	04	8-64 bits	3001-4000	30001-40000
Holding Registers (Read/Write)	03, 06, 16	8-64 bits	4001-5000	40001-50000

* Data types may be implemented at the discretion of the manufacturer. Address ranges may also over lap. Discrete is a binary or boolean value, 1 or 0.
Function codes, memory types, and addresses can be converted to the PLC addressing equivalent using the table below. To use the table, look up the row corresponding to the Modbus function code. Then take the desired X-332™ feature address and add to it the address offset in the PLC address mode column.

Input Address + PLC Base Address = PLC Address

For example, to read discrete Input 2

Input Address 1
PLC Base address 1001
PLC Address 1002

Programming the PLC to read from 1002 will return the value of Input 2.

Code Name	Modbus Function	X-332 Addresses	Data Type	PLC Address Mode 485	PLC Address Mode 584/984
Read Coils	01	0-15 (Relays 1-6)	Discrete	Addr + 1	Addr + 1
Read Discrete Inputs	02	0-17 (Inputs 1-18)	Discrete	Addr + 1001	Addr + 10001
Read Holding Registers	03	16-23 (Analog 1-4)	32-bit float	Addr + 4001	Addr + 40001
		272-278 (Sensors 1-4)	32-bit float	Addr + 4001	Addr + 40001
		528-530 (Counters 1-2)	32-bit int	Addr + 4001	Addr + 40001
Write Coils	05	0-15 (Relays 1-16)	Discrete	Addr + 1	Addr + 1
Write Multiple Coils	15	0-15 (Relays 1-16)	Discrete	Addr + 1	Addr + 1
Write Multiple Registers	16	528-530 (Counters 1-2)	32-bit int	Addr + 4001	Addr + 40001
		784-815 (Relays 1-16)	32-bit float	Addr + 4001	Addr + 40001

For 32-bit numbers, two registers must be read starting at the desired address, examples of each are given for the applicable functions.

3.4.3 X-332™ Sample Address Table

The table below gives commonly used function codes, memory types, data sizes, and equivalent PLC addresses for accessing the X-332. The data size will be the same regardless of the addressing mode. This table is does not include every combination, but rather a sample of combinations.

	Function Code	Address (Decimal)	Data Size	PLC Address Mode 485	PLC Address Mode 584/984
Read Relay 1	01	0	Discrete	1	1
Read Relay 2	01	1	Discrete	2	2
Read Relay 3	01	2	Discrete	3	3
Read Relay 4	01	3	Discrete	4	4
Write Relay 1	05	0	Discrete	1	1
Write Relay 2	05	1	Discrete	2	2
Write Relay 3	05	2	Discrete	3	3
Write Relay 4	05	3	Discrete	4	4
Read Input 1 State	02	0	Discrete	1001	10001
Read Input 2 State	02	1	Discrete	1002	10002
Read Input 3 State	02	2	Discrete	1003	10003
Read Input 4 State	02	3	Discrete	1004	10004
Read Analog 1	03	16	32-bit Float	4017	40017
Read Analog 1	03	18	32-bit Float	4019	40019
Read Analog 1	03	20	32-bit Float	4021	40021
Read Analog 1	03	22	32-bit Float	4023	40023
Read Sensor 1	03	272	32-bit Float	4273	40273
Read Sensor 2	03	274	32-bit Float	4275	40275
Read Sensor 3	03	276	32-bit Float	4277	40277
Read Sensor 4	03	278	32-bit Float	4279	40279
Read Counter 1	03	528	32-bit int	4529	40529
Read Counter 2	03	530	32-bit int	4531	40531
Write Multiple Relays	15	0	8-bit	1	1
Set Counters	16	528	32-bit int	4529	40529
Pulse Relays	16	784	32-bit Float	4785	40785

3.4.4 Read Coils - Modbus Function Code 01 (0x01)

Read the state of the relays.

Request

Start Address: 0x0000 (coil 1) to 0x000F (coil 16)
Coil Quantity: 0x0001 (1 coil) to 0x0010 (16 coils)
All relays may be read at the same time by specifying the correct starting address and quantity of coils to be read.

Response

The X-332™ will respond to the request with a data field of two bytes, each bit representing the coil status. A '1' indicates the Output is ***ON***. A '0' indicates that the Output is ***OFF***.
Bit zero of the return value will be the state of the coil corresponding to the start address. For example, if a start address of 0x0001 is used, bit zero will be the status of Relay 2.

Coil State Byte 2							
Bit 15	**14**	**13**	**12**	**11**	**10**	**9**	**Bit 8**
Relay 16	Relay 15	Relay 14	Relay 13	Relay 12	Relay 11	Relay 10	Relay 9

Coil State Byte 1							
Bit 7	**6**	**5**	**4**	**3**	**2**	**1**	**Bit 0**
Relay 8	Relay 7	Relay 6	Relay 5	Relay 4	Relay 3	Relay 2	Relay 1

Errors

The sum of the start address and coil count cannot exceed the maximum coil count or an error response will be returned.
The following are possible error responses.
Coil Read Error Function Code (1 byte): 0x81
Exception Codes (1 byte): 0x01 – Function code not supported.
0x02 – Incorrect combination of start address and quantity of Relays

3.4.5 Read Discrete Inputs – Modbus Function Code 02 (0x02)

This function returns the state of the digital inputs.

Request

Start Address: 0x0000 (input1) to 0x0011 (Input 18)
Input Quantity: 0x0001 to 0x0012
The sum of the starting address and the quantity of coils must not be greater than 0x0012. For example, if you want to read 0x0002, two inputs, then the start address must be 0x0000. To read the second input only the start address is 0x0001 with a quantity of 0x0001.

Response

The X-332™ will respond to the request with a data field of three bytes, each bit representing the input state. A `1` indicates that the input is switched high ***ON***. A `0` indicates that the input switched low ***OFF***. Bit zero of the return value will be the state of the coil corresponding to the start address. For example, if a start address of 0x0001 is used, bit zero will be the status of input 2.

When reading all 18 inputs, the following table shows the bit positions.

Discrete Input State Byte 3							
Bit 23	**22**	**21**	**20**	**19**	**18**	**17**	**Bit 16**
X	X	X	X	X	X	Input 18	Input 17

Discrete Input State Byte 2							
Bit 15	**14**	**13**	**12**	**11**	**10**	**9**	**Bit 8**
Input 16	Input 15	Input 14	Input 13	Input 12	Input 11	Input 10	Input 9

Discrete Input State Byte 1							
Bit 7	**6**	**5**	**4**	**3**	**2**	**1**	**Bit 0**
Input 8	Input 7	Input 6	Input 5	Input 4	Input 3	Input 2	Input 1

Errors

Input Read Error Function Code (1 Byte): 0x82
Exception codes (1 Byte): 0x01 – Function not supported.
0x02 – Incorrect combination of start address and input quantity.

3.4.6 Read Sensors – Modbus Function Code 03 (0x03)

The Read Holding Registers function is used for the counters, analog inputs, temperature and humidity sensors.

Request

32-bit sensor values are read from 16-bit register pairs. Consequently, senors addresses and registers must be even numbers.

Analog Start Addresses

Start Address: 0x0010 (Analog Input 1) to 0x0016 (Analog Input 4)
Input Quantity: 0x0002 to 0x0008

Temperature and Humidity Sensor Start Addresses

Start Address: 0x0110 (Sensor Input1) to 0x0116 (Sensor Input 4)
Input Quantity: 0x0002 to 0x0008

Counter Input Start Addresses

Start Address: 0x0210 (Counter 1) to 0x0212 (Counter 2)
Input Quantity: 0x0002 to 0x0004

Response

32-bit floating-point values are returned, either as little-endian or big-endian numbers, depending on the configuration in the **Advanced Network** tab.
With little-endian ordering, a temperature reading of sensor 1 (0x0110) would return 0x800042A2. The least significant word would be 8000 hex and the most significant word would be 42A2. This hexadecimal value converts to a temperature reading of 81.25 degrees.
If a temperature or humidity sensor is not installed, a value of 0xFFFFFFFF (NaN) is returned. Other inputs will show measured values of the open circuits.

Errors

Sensor Read Error Function Code (1 byte): 0x83
Exception Codes (1 byte): 0x01 – Function not supported.
0x02 – Incorrect combination of start address and input quantity

3.4.7 Write Single Coil – Modbus Function Code 05 (0x05)

Relays may be controlled one at a time.

Request

Start Address (2 bytes): 0x0000 (Relay 1) – 0x0000F (Relay 16)
Output Value (1 byte): 0x00 (OFF), 0xFF(ON)
Padding (1 byte): 0x00

Response

The response mirrors the requested state, 0x00 or 0xFF.

Errors

Single Coil Write Error Function Code (1 Byte): 0x85
Exception codes (1 Byte): 0x01 – Function not supported.
0x02 – Address out of range.
0x03 – Padding value.

3.4.8 Write Multiple Coils - Modbus Function Code 15 (0x0F)

Multiple bytes can be written to set the state of all relays, each bit representing one relay.

Request

Relay states are controlled by specifying the start address of the first relay to be controlled, the count of the relays to be affected, and the relay state byte(s).
A relay value of 0xFFFF would be used to turn ***ON*** all sixteen of the relays and 0x0000 would turn them ***OFF***.

Start Address (2 bytes): 0x0000 (Relays 1) – 0x000F (Relays 16)
Output Quantity (2 bytes): 0x0001 – 0x0010
Byte Count (1-2 bytes): 0x01
Relay Value (2 bytes): 0x0000 – 0xFFFF

Relay State Byte 2							
Bit 15	**14**	**13**	**12**	**11**	**10**	**9**	**Bit 8**
Relay 16	Relay 15	Relay 14	Relay 13	Relay 12	Relay 11	Relay 10	Relay 9

Relay State Byte 1							
Bit 7	**6**	**5**	**4**	**3**	**2**	**1**	**Bit 0**
Relay 8	Relay 7	Relay 6	Relay 5	Relay 4	Relay 3	Relay 2	Relay 1

Response

The quantity value is returned.

Errors

Multiple Coil Write Error Function Code (1 Byte): 0x8F
Exception codes (1 Byte): 0x01 – Function not supported.
0x02 – Incorrect combination of start address and Relay quantity
0x03 – Byte count out of range.

3.4.9 Write Multiple Registers – Modbus Function Code 16 (0x10)

The Modbus Write Multiple Registers function can be used to set the counter to a specific value or pulse the relays.

Request

Set Counters

The counter value is specified using a 32-bit integer (not a floating point number).

Start Address (2 bytes):	0x0210 (counter 1) - 0x0212 (counter 2)
Register Quantity (2 bytes):	0x0002 - 0x0004 (2 registers for each counter, even number)
Byte Count (1 byte):	0x04 - 0x08 (Multiples of 4)
Counter Quantity (4 bytes/Counter):	0x00000000 – 0xFFFFFFFF

Pulse Relay

The Modbus Write Multiple Registers function is used to pulse the relay(s) for a specified time. When X-332™ receives this command, it immediately turns the appropriate relay(s) ***ON*** (if not already on) and starts the pulse timer. The relay(s) are selected by writing the pulse time in seconds to the register(s) associated with the desired relay(s).
The pulse time is specified using floating point format in the register value field and can range from 0.1 seconds to 86400 seconds (1 day). When the pulse time expires, the relay will be turned ***OFF***. If a pulse time command is sent with a value greater than 86400, the pulse timer will be set to 86400. If a pulse time command is sent with a value less than 0.1, the pulse timer will be set to 0.1.
If any commands are sent to X-332™ (Modbus, XML, SNMP, or HTML) before the pulse timer has expired, the pulse timer will be canceled immediately and the new command will be executed.
IEEE 754 floating point format is used for the pulse time. X-332™ may be configured for little-endian or big-endian transmission. The endian-ness is configured in the **Advanced Network** tab. (See **2.4.3 Advanced Network Tab** for more information.)

Start Address (2 bytes):	0x0310 (relay 1) – 0x032F (relay 16)
Register Quantity (2 bytes):	0x0002 – 0x0020 (2 registers for each relay, even number)
Byte Count (1 byte):	0x04 – 0x40 (Multiples of 4)
Pulse Duration (4 bytes/relay):	0x3DCCCCCC – 0x47A8C000 (big-endian) 0xCCCC3DCC – 0xC00047A8 (little-endian)

Response

The request is acknowledged by responding with the register quantity that was requested.

Errors

Pulse Function code Error (1 Byte):	0x90
Exception codes (1 Byte):	0x01 – Feature not supported. 0x02 – Address quantity not an even number. Incorrect combination of start address and relay count.

3.5 Email Notification

3.5.1 Email Notification Description

X-332™ can be configured to send messages to three email addresses when certain events occur. Events that can trigger email messages include relay/input state changes, analog inputchanges, temperature/humidity changes, and commands sent from a BASIC script.
When an email message is sent, it looks similar to this:

```
X-332

Trigger: Relay 1 ON

Relay 1: ON
Relay 2: OFF
Relay 3: OFF
Relay 4: OFF
Input 1: OFF
Input 2: OFF
Input 3: OFF
Input 4: OFF
Analog 1: 4.00 V
Sensor 1: 76.2° F
Sensor 2: 73.7° F
Sensor 3: 32.0° F
Sensor 4: 84.5° F
Count 1: 5.00
Count 2: 0.00
```

Note: Relays, Inputs, Count, and Sensor names as well as ON and OFF status text may be customized by the user (installer) in the setup pages. The same field names are used on the Control Page.

Subject Line

The top line (that reads X-332), appears in the subject line of the email message. This is the same text that appears as the header on the **Control Page**. It is set in the Main Header Text field under the **Control Page Setup** tab.

Trigger

The first line displayed in the body of the message shows the event that triggered the message. The text “Trigger” will always appear and cannot be changed. The remaining text includes the trigger name, and what caused the trigger. The text that describes the trigger and its current state are configured in the setup pages as described below.

Current Status of the Digital Inputs, Relays, Analog Inputs, and Sensors

The remainder of the email message will display the same information shown on the **Control Page**. Fields not displayed in the **Control Page** will not be included in the email message. Displayed fields may be configured in the **Control Page Setup** page.

3.5.2 Email Notification Setup

Email notification requires that the following fields are properly configured. See **Section 2.4.2** for a description of each field.

Network Tab

IP Address
Subnet Mask
Gateway
Preferred DNS Server (this is required if Mail Server is entered by name and not by IP address)
Alt DNS Server
Mail Server (SMTP)
User Name (If Required)
Password (If Required)
Return Email
Email 1
Email 2
Email 3

Note: *X-332™ must be power-cycled (power disconnected, then reconnected) before network settings take effect. Only the settings on the* ***Network*** *tab require power-cycling before taking effect.*
Email triggers can be generated within a BASIC script (See **Appendix G: BASIC Scripts**), or can be explicitly defined for each Relay, Input, and sensor under the **Relay**, **Input,** and **Sensors** tabs.
The email options and recipients for each Relay, Input, and Sensor are configured separately. Select the the Email Option and the check box for the desired email recipient for each Relay, Input, and Sensor.

Once the email settings are entered, the email functionality can be tested by entering the following command:

```
http://IP address/state.xml?testEmail=1
```

For example, using the default IP address, enter:

```
http://192.168.1.2/state.xml?testEmail=1
```

This will cause an email message to be sent immediately. If the messages don't get through, the system log file may have some clues to assist in diagnosing the problem (http://192.168.1.2/syslog.txt). See **Appendix D: Log Files** for additional Logging Information.

Appendix A: Restoring Factory Default Settings

In the event that the IP address or passwords are forgotten, X-332™ may be restored to its original factory default settings.

1. Remove the DC power from the unit. This will also turn off the Output(s).
2. Use a thin, non-conductive object (such as a toothpick) to press and hold the small button located on the side of the unit, next to the Ethernet port. When the object is inserted, a tactile feedback can be felt as the button is depressed.

   CAUTION: DO NOT USE METAL OBJECTS FOR THIS FUNCTION.
3. While depressing the button, the green and yellow network LEDs will flash, apply power and wait for about 10 seconds before releasing the button. All settings will be back to the original factory defaults. log.txt and syslog.txt are retained.
4. Refer to **Section 2.3 Establishing Communications for Setup** to begin reconfiguration of the device.

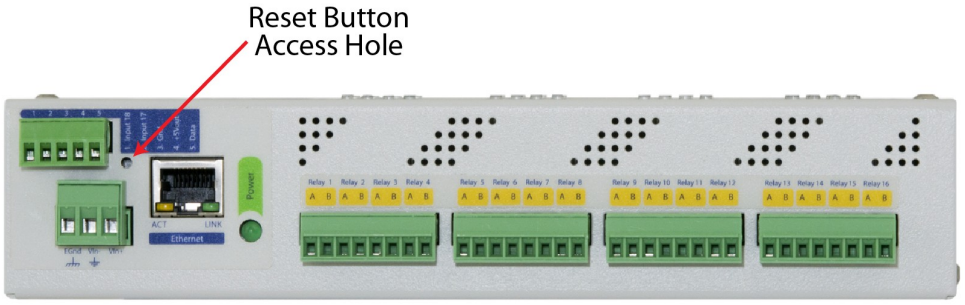


Figure Appendix A.1 - Restore Factory Defaults

Appendix B: Installing New Firmware

From time to time, updates are made to the X-332™ firmware. The firmware can be updated in the field. The procedure for updating the firmware is outlined below. Please note that it is important that this procedure is followed precisely.

Requirements

The firmware update software requires Windows XP/Vista/7 with the .Net framework installed. The .Net framework is generally installed automatically through Windows update. To install it manually, go to the following address:

http://www.microsoft.com/downloads/details.aspx?FamilyId=333325FD-AE52-4E35-B531-508D977D32A6&displaylang=en

Select the Download button. Once you've downloaded the installation file, double click on the installation file to install the framework.

Setup

1. Download the firmware zip file from the ControlByWeb website. Only a X-332™ image can be installed on the X-332™ so make sure the correct image is being downloaded.
2. bootloader.exe will connect to the X-332™ using default IP address 192.168.1.2, not the address currently assigned to the X-332™. After the update, all settings will be lost and the device will return to its default IP address of 192.168.1.2.

   Configure the PC to the same subnet as the IP address 192.168.1.2, such as 192.168.1.10. For instructions on doing this see section **2.3 Establishing Communications for Setup**.

   Note: The IP address of X-332™ will automatically be set to the default 192.168.1.2 during the update process.
   Note: A crossover cable cannot be used during the update procedure, an ethernet switch will be necessary to properly update the firmware.

Figure Appendix B.1 - Firmware Update Utility

3. Open the bootloader.exe utility on the computer by double clicking on the downloaded file (Figure Appendix B.1).
4. Within the ControlByWeb™ Programmer utility programmer, select File, then Open. Specify the firmware image downloaded from the ControlByWeb™ web site.

Device Upgrade Procedure

Carefully follow the following steps to put the X-332™ into bootloader mode and perform the upgrade:

1. Remove DC power from X-332™.
2. Using a small, non-conductive tool, press and hold the reset button.
3. While holding the reset button, apply power to X-332™. The LINK and ACT lights will flash. Continue to hold the reset button for the next step.
4. While holding the reset button, press the Upload Firmware button at the bottom of the ControlByWeb™ Programmer window. After the programming process begins, the reset button can be released
5. Programming will take approximately 20-30 seconds, the LINK LED will stop flashing and remain lit. X-332™ will be set to factory defaults with an IP address of 192.168.1.2.
6. Refer to section **2.3 Establishing Communication for Setup** to reconfigure the X-332™. Verify the new version of firmware has been installed by viewing the default setup page with a web browser (http://192.168.1.2/setup.html).

Figure Appendix B.2 - Firmware Update Complete

Appendix C: Accessing X-332™ Over the Internet

X-332™ can be monitored and/or controlled from a remote location over the Internet. Once X-332™ can be accessed on the local network, almost all of the settings required to provide remote access are in the router and not in X-332™. This guide is not meant to be a tutorial in router setup, but rather to provide a basic overview of remote access. For specific details, the user should refer to the instruction manual for the router on the local network. Users not familiar with basic IP networking should study one or more basic IP networking tutorials before proceeding (many tutorials are available on the Internet).

IP Addresses

Every device on the Internet is identified by a unique address called an IP (Internet Protocol) address. IP addresses are somewhat similar to mailing addresses in that they identify the precise logical location of the device on the Internet. The IP address identifies the global region down to the network and then the specific device on that network. IP addresses are globally maintained and assigned by an entity called the Internet Assigned Numbers Authority (IANA). IP addresses consist of four sets of numbers that range from 0 to 255 and are separated by a decimal. For example, 192.168.200.167 is an IP address.

Every device that is “directly” connected to the Internet uses a “public” IP address. X-332™ can be assigned a public IP address for direct connection to the Internet. Typically, a public IP address to would only be assigned to X-332™ when it is the only device on the local network. The IP address would be obtained from an Internet Service Provider (ISP).

Due to the limited number of public IP addresses, private networks can be set up with “private” IP addresses. These addresses are used within a local network and have no global designation, they are not routed on the Internet. The following address blocks are designated for private networks (where x represents decimal numbers from 0 to 255): 192.168.x.x, 10.x.x.x, and 172.16.x.x.

A Simple Local Area Network

A small Local Area Network (LAN), can be made up of two or more computers or other devices connected to an Ethernet switch. Each device on the network is assigned a unique private IP address. For example, consider a simple network that consists of a computer, an X-332™, and a WebRelay™. In this example, the computer is assigned an IP address of 192.168.1.10, X-332™ has the IP address of 192.168.1.25 and a WebRelay™ has and IP address of 192.168.1.26. A person using the computer can access X-332™ by entering its IP address in the URL line in the browser,http://192.168.1.25. Similarly, WebRelay™ can be accessed by entering its unique private IP address in the URL line in the browser, http://192.168.1.26.

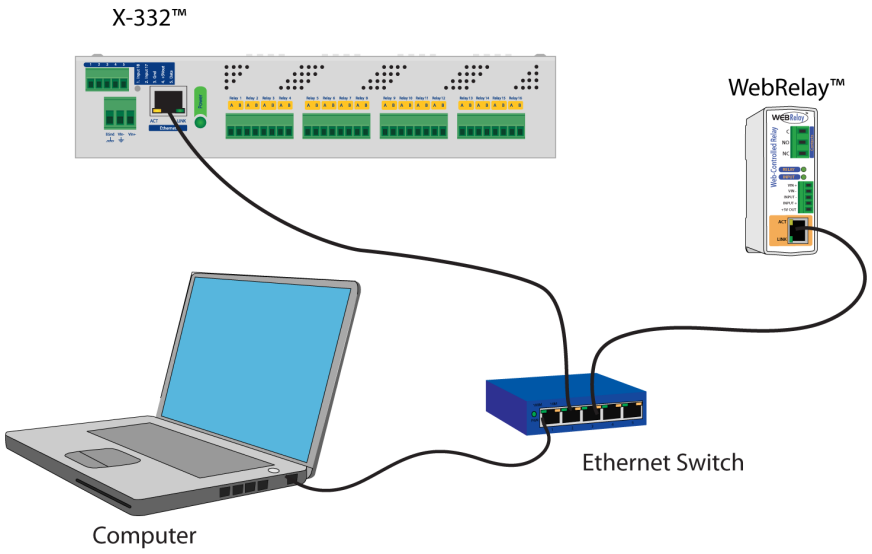


Figure Appendix C.1 - Local Area Network

A Simple LAN connected to the Internet

The LAN in the example above can be connected to the Internet by adding a router and an Internet connection. The router has two network connections. It has an Ethernet network connection to the LAN and another connection to the Internet. Often the Internet connection is called a Wide Area Network (WAN) connection. Each network connection on the router has an IP address. In our example, the IP address on the LAN side of the router has an address of 192.168.1.1. The IP address on the WAN side of the router has an IP address that has been assigned by the Internet Service Provider, such as 266.70.164.97. (This is not a valid IP address because each number cannot be larger than 255 It is used in this example for illustration purposes only.)

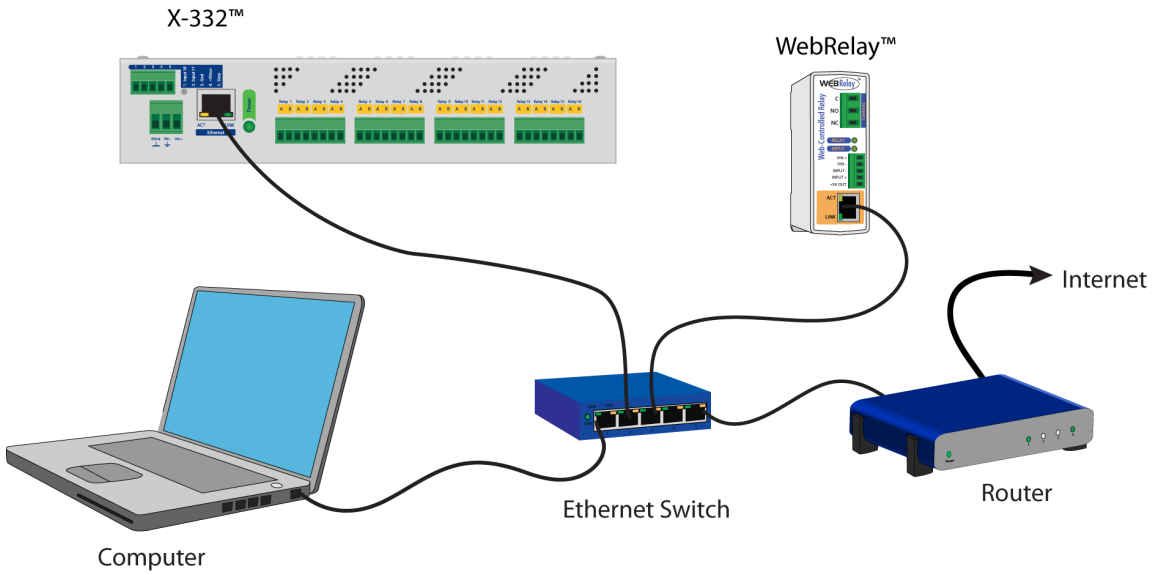


Figure Appendix C.2 - LAN Connected to the Internet

In the example, when a user on the computer needs to access a server on the Internet, the computer sends the request to the router at 192.168.1.1. The router sends the request to the ISP server on the Internet. The ISP server does not send the response directly to the computer on the LAN, but to the router at the IP address of 266.70.164.97. The router then forwards the response to the computer. This way, all devices on the LAN share a single public IP address. This is called Network Address Translation (NAT).

Port Forwarding

The router can be configured to allow outside access to X-332™ and WebRelay™. All requests from the Internet to any device on the local network must use the public IP address (266.70.164.97). With only a single IP address, TCP ports are used to identify the intended device for the incoming message.

Using the mailing address analogy, the port is similar to a post office box. The IP address specifies the location, and the port specifies the specific recipient. Port numbers can be set to any number between 1 and 65235. However, many port numbers are reserved for specific applications and should be avoided. As a general rule, numbers above 8000 are safe to use. All of the ControlByWeb™ products come from the factory with the HTTP port set to 80, which is the standard port for HTTP. In this example, X-332™ HTTP port will be changed to port 8000 and WebRelay™ port will be changed to 8001. Once the ports are changed in the two ControlByWeb™ devices, the router must be set up for port forwarding.

Port forwarding associates the IP address of each local device with an assigned port. In this example, the address 192.168.1.25 for X-332™ would be associated with port 8000. The address 192.168.1.26 for WebRelay™ would be associated with port 8001. X-332™ would be accessed from the Internet by entering the public IP address of the router, plus the port number assigned to X-332™ in the URL window of the browser, http://266.70.164.97:8000. All Internet requests to the router for port 8000 would be forwarded to X-332™. Similarly, all request for port 8001 would be forwarded to WebRelay.

Note: When an HTTP request comes in to the router without the specific port specified (http://266.70.164.97), the router will handle this as a port 80 request (default HTTP port). In other words, http://266.70.164.97 is exactly the same as http://266.70.164.97:80.

Router configuration can vary widely. Some routers have the capability of translating the addresses and the ports, which would require no port configuration change on the WebRelay. For example, the router would be configured so that messages sent to http://266.70.164.97:8000 would be forwarded to http://266.70.164.97:80, which is the default HTTP port.

An example screen shot of a router configuration is given below. This setup allows the two ControlByWeb™ products in the above example to be accessed remotely from the Internet.

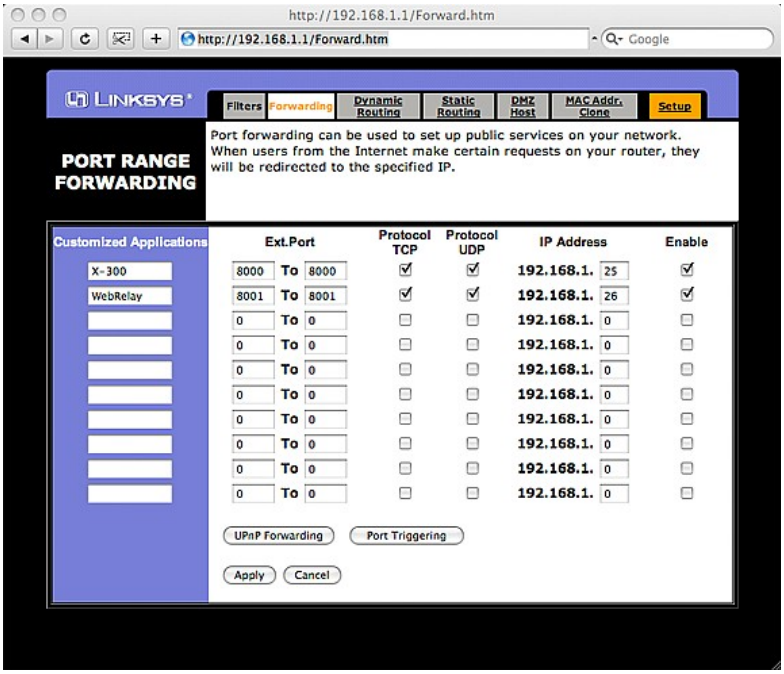


Figure Appendix C.3- Port Range Forwarding

Note: This screen shot is simply an example of a typical router setup page. Routers will vary.

Accessing Setup Pages

After changing ports, the setup pages are accessed on a local network as described below:

```
http://(Local IP Address):(Port Number)/setup.html
```

For example, to access the setup pages when the port is set to 8000, the following command would be used:

```
http://192.168.1.25:8000/setup.html
```

To access the ControlByWeb™ units from the Internet, enter the public IP address of the router plus the port number of the desired device in the following format:

```
http://(Public IP Address of Router):(Port Number of Device)/setup.html
```

Using the example above, the following line would be used to access the setup page of X-332™:

```
http://266.70.164.97:8000/setup.html
```

Appendix D: Log Files

X-332™ logs information to two different log files; log.txt and syslog.txt. Both log files are text files and are stored in nonvolatile memory; this data will not be lost due to power failure and is also not cleared when restoring factory defaults. The log files are stored in circular buffers which write from the beginning of the allocated memory space to the end and then repeat from the beginning (over-writing the original data). The nonvolatile memory is divided into 4K byte sectors. Each time data gets erased to make room for new data, a full sector (4K bytes) is erased at one time.

Data Log File – log.txt

This log file is user-configurable under the **Logging** setup tab, and stores real-world data such as temperatures and events such as relay state changes (see section **2.4.6 Logging Tab** for more information). It can be up to 512K bytes long and is stored using a comma separated value formatting scheme.

Inputs, Relays, Counters, Analog Inputs, and Sensors will only be displayed if they are selected in the **Logging** setup tab. The file is read by requesting the log.txt file from X-332™. For example, using the default IP address the following command would be used to request the log file:

```
http://192.168.1.2/log.txt
```

File Format:

```
MM/DD/YYYY HH:MM:SS, Input 1-4, Relay 1-4, Counters 1-2, Sensors 1-4, Trigger:
Source
```

Date and Time Format:

MM – Month (1-12)
DD – Day (1-31)
YYYY – Year (1970 - 2106)
HH – Hour in 24 hour time (0 -23)
MM – Minutes (0-59)
SS – Seconds (0-59)

Sample File:

```
Date Time,Relay 1,Trigger
07/30/2012 10:30:00,0,I/O:()
07/30/2012 11:00:00,1,I/O:()
07/30/2012 11:30:00,0,I/O:()
07/30/2012 12:00:00,1,I/O:()
07/30/2012 12:30:00,0,I/O:()
07/30/2012 13:00:00,1,I/O:()
```

The file can then be saved using the 'Save As...' option under the 'File' menu of the web browser. If the TCP port has been changed (not port 80), the port will be required to read the file. For example, using the default IP address, and port 8000, the log file would be read as follows:

```
http://192.168.1.2:8000/log.txt
```

The log.txt file may be erased with the following command:

```
http://192.168.1.2/log.txt?erase=1
```

After erasing the file, it might be necessary to refresh the page.

Note: If the Control Password is enabled in the setup pages, the password will be required to access the log file.

System Log File – syslog.txt

The syslog.txt file records various system events, which can be used for diagnostics and troubleshooting purposes.

File Format:

```
MM/DD/YYYY HH:MM:SS, (category to which message applies): (message)
```

Sample File:

```
01/02/2010 04:08:13 DEVICE: Power Up.
01/01/2010 00:41:05 DEVICE: Reset factory defaults.
```

Listed below is a description of messages that a user may see:

Category	Message	Description
DEVICE	Power Up	Device has been properly powered.
	Initialize	Device is ready.
	Reset Factory Defaults	Device has been reset to factory defaults.
EMAIL	Failed DNS Lookup	Unable to lookup mail server due to an incorrect DNS setting.
	Bad Username	Email was not sent due to an incorrect user name.
	Bad Password	Email was not sent due to an incorrect password.
	Authentication Required	A user name and password are required by the mail server.
	No Response	No response from SMTP server.
CLOCK	RTC Reset	Real Time Clock has been reset.
NTP SERVER	Request Attempt	Device attempting to connect to NTP Server
	Failed DNS Lookup	Unable to lookup NTP server name due to an incorrect DNS setting.
	Success	Device successfully connected to NTP Server.
REMOTE SERVER	Failed DNS Lookup	Unable to lookup Remote Server due to an incorrect DNS setting.
	Connection Attempt Started	Connection port with Remote Server has been opened.
	Connection Closed	Connection port with the Remote Server has been closed.
DHCP	Address Acquired	IP address request successful, and IP address assigned.
	Lease Renewal	IP address assigned to device was renewed.
MAIN_MCU	New Firmware Loaded	New firmware has been loaded to the device.

This file is read by requesting the syslog.txt file. For example, using the default IP address the following command would be used:

```
http://192.168.1.2/syslog.txt
```

Note: The setup user name and password are required to access this file.

If the TCP port has been changed (not port 80), the port will be required to read the file. For example, using the default IP address, and port 8000, the log file would be read as follows:

```
http://192.168.1.2:8000/syslog.txt
```

To erase the file, use:

```
http://192.168.1.2/syslog.txt?erase=1
```

Appendix E: External Server and Remote Services

Note: The following methods are supported by X-332™; however, Xytronix Research & Design, Inc. does not provide or support custom third party applications, or external web servers.

Accessing X-332™ with Custom Software or Third Party Applications

Custom applications can send commands to X-332™ for monitoring and control functions using XML. (See **3.2 XML Operation** for more information.) The application interface can be used to provide a custom user interface, access to multiple units in a single screen, and allow for automation, logging, and other application-specific features.

Using an External Web Server

Rather than accessing X-332™ directly from a computer, an external web server can be used. The term “external” web server is used here to mean a separate web server (such as Apache or IIS) that is not the web server built into X-332™. In this scenario, users access custom web pages that reside on the external web server and the external web server communicates with X-332™.

An external web server can integrate multiple ControlByWeb products into a single control page. In other words, the user may not be aware that he/she is using multiple ControlByWeb™ devices, but rather the user sees an integrated control page for the entire system. In addition, the use of an external web server allows programmers to create custom user interfaces that take advantage of the additional resources typically available on larger web servers, including more memory and various web programming languages.

There are two approaches that an external server can use to communicate with X-332™ and other ControlByWeb™ devices, Direct Server Control and Remote Services.

Direct Server Control

The first approach is for the external server to create a TCP connection whenever it needs to access X-332™. In this case, the external server opens the connection, sends commands and/or reads the device, and closes the connection.

This method is ideal when the the web server and all of X-332™ devices are on the same network (without routers between them). In this case, the server can communicate with X-332™ devices directly and securely since data never has to leave the local network.

When the server and X-332™ are on different networks, routers must be configured to allow appropriate access. If a public network is used, such as the Internet, security precautions should be considered.

Remote Services

The second approach is for X-332™ to initiate a connection using the “Remote Services.” The settings under the **Advanced Network** tab in the setup pages will enable the X-332™ to open a TCP connection with an external server. Once the connection is open, the external server can send commands and/or read the device. The external server can leave the connection open (so that it never closes) or close the connection.

“Remote Services” is ideal for installations where the server and X-332™ are installed on different networks. This is especially useful when each X-332™ is installed on a separate private network. For example, if the user doesn't control the network connections where X-332™ is installed, “Remote Services” would initiate a TCP connection over the Internet with the control computer. Since X-332™ initiates the connection, the control computer doesn't have to know the IP address of X-332™. This means that X-332™ can be installed using DHCP. In addition, no special router configuration is required. This makes the network installation of X-332™ very simple, and since no incoming ports need to be

opened in the router, security is not compromised. See section **2.4.3 Advanced Network Tab** for more information.

X-332™ can be configured to establish a connection when triggered by an event, such as a I/O state changing. This is done by setting the Remote Service/SNMP checkbox in the I/O setup tabs.

When an event occurs and a connection is open, the state.xml file is sent.

If a connection is not open and Remote Services is enabled, a connection will be established by sending the connection string. Once the connection is established state.xml will be sent.

Connection String

With Remote Services enabled, a connection attempt will be made periodically according to the Connection Interval setting in the **Advanced Network** setup tab. The Connection String is a user-defined character string configured in the **Advanced Network** tab.

The connection string is also sent at the same interval once the connection is open. The external server is responsible for closing the connection when it is done.

Appendix F: SNMP Requests, Objects and Community Strings

Digital input states, counter inputs states, relay states, analog inputs, temperature/humidity, and some simple network parameters can be retrieved using Simple Network Management Protocol(SNMP). The states of the relays can be changed through SNMP requests. For most cases, using SNMP is as simple as locating the appropriate Management Information Bases (MIB) files and loading them into the SNMP manager software. X-332™ can make use of the following MIB files: RFC1213-MIB and XYTRONIX.mib.

Note: As additional ControlByWeb products are introduced, the Xytronix MIB file will remain reverse compatible, older MIB files can be overwritten.

SNMP is configured under the **Advanced Network** setup tab. See section **2.4.3 Advanced Network Tab** for more information.

X-332™ supports the following Packet Data Units (PDU):

- GetRequest
- GetNextRequest
- SetRequest
- Trap

Standard Objects

X-332™ supports several standard RFC1213 objects that usually come with SNMP management software. If not, an Internet search for RFC1213-MIB will turn up multiple links.

RFC1213 Object	Response
`system.sysDescr`	X-332
`system.sysObjectID`	X332
`system.sysUpTime`	Time in hundredths of seconds since X-332™ was last powered.
`system.sysName`	X-332*

*The sysName is customizable under the **Control Page Setup** tab.

Xytronix Objects

X-332™ also supports some special objects that can be found in the XYTRONIX.mib. This MIB can be downloaded from our website.

Read Only Objects:

Inputs

Object	Input Type	Response
x332_inputOne	Digital	Value: 0 or 1 (0 – OFF, 1 – ON)
x332_inputTwo	Digital	Value: 0 or 1
x332_inputThree	Digital	Value: 0 or 1
x332_inputFour	Digital	Value: 0 or 1
x332_inputFive	Digital	Value: 0 or 1 (0 – OFF, 1 – ON)
x332_inputSix	Digital	Value: 0 or 1 (0 – OFF, 1 – ON)
x332_inputSeven	Digital	Value: 0 or 1 (0 – OFF, 1 – ON)
x332_inputEight	Digital	Value: 0 or 1 (0 – OFF, 1 – ON)
x332_inputNine	Digital	Value: 0 or 1 (0 – OFF, 1 – ON)
x332_inputTen	Digital	Value: 0 or 1 (0 – OFF, 1 – ON)
x332_inputEleven	Digital	Value: 0 or 1 (0 – OFF, 1 – ON)
x332_inputTwelve	Digital	Value: 0 or 1 (0 – OFF, 1 – ON)
x332_inputThirteen	Digital	Value: 0 or 1 (0 – OFF, 1 – ON)
x332_inputFourteen	Digital	Value: 0 or 1 (0 – OFF, 1 – ON)
x332_inputFifteen	Digital	Value: 0 or 1 (0 – OFF, 1 – ON)
x332_inputSixteen	Digital	Value: 0 or 1 (0 – OFF, 1 – ON)
x332_inputSeventeen	Digital	Value: 0 or 1 (0 – OFF, 1 – ON)
x332_inputEighteen	Digital	Value: 0 or 1 (0 – OFF, 1 – ON)

Counters

Scaled values are reported.

Object	Response
x332_counterOne	Value: 0.0 (Current count)
x332_counterTwo	Value: 0.0 (Current count)

Analog Inputs

Scaled values are reported.

Object	Response
x332_analogOne	Value: 0.0 (Current analog value)
x332_analogTwo	Value: 0.0 (Current analog value)
x332_analogThree	Value: 0.0 (Current analog value)
x332_analogFour	Value: 0.0 (Current analog value)

Sensors

Object	Response
x332_sensorOne	Value: x.x (Decimal temperature or humidity.)
x332_sensorTwo	Value: x.x (Decimal temperature or humidity.)
x332_sensorThree	Value: x.x (Decimal temperature or humidity.)
x332_sensorFour	Value: x.x (Decimal temperature or humidity.)

Read/Write Objects:

Relays – Read/Write

A Get request will return the current state. A Set request of 0 or 1 will turn the Relay ***ON*** or ***OFF***. A Set request of 2 will pulse the Relay for the time configured in the setup page.

Object	Response	Set Value
x332_relayOne	Value: 0 or 1	0 - OFF, 1 - ON, 2 - PULSE
x332_relayTwo	Value: 0 or 1	0 - OFF, 1 - ON, 2 - PULSE
x332_relayThree	Value: 0 or 1	0 - OFF, 1 - ON, 2 - PULSE
x332_relayFour	Value: 0 or 1	0 - OFF, 1 - ON, 2 - PULSE
x332_relayFive	Value: 0 or 1	0 - OFF, 1 - ON, 2 - PULSE
x332_relaySix	Value: 0 or 1	0 - OFF, 1 - ON, 2 - PULSE
x332_relaySeven	Value: 0 or 1	0 - OFF, 1 - ON, 2 - PULSE
x332_relayEight	Value: 0 or 1	0 - OFF, 1 - ON, 2 - PULSE
x332_relayNine	Value: 0 or 1	0 - OFF, 1 - ON, 2 - PULSE
x332_relayTen	Value: 0 or 1	0 - OFF, 1 - ON, 2 - PULSE
x332_relayEleven	Value: 0 or 1	0 - OFF, 1 - ON, 2 - PULSE
x332_relayTwelve	Value: 0 or 1	0 - OFF, 1 - ON, 2 - PULSE
x332_relayThirteen	Value: 0 or 1	0 - OFF, 1 - ON, 2 - PULSE
x332_relayFourteen	Value: 0 or 1	0 - OFF, 1 - ON, 2 - PULSE
x332_relayFifteen	Value: 0 or 1	0 - OFF, 1 - ON, 2 - PULSE
x332_relaySixteen	Value: 0 or 1	0 - OFF, 1 - ON, 2 - PULSE

TRAPS

X-332™ can send SNMP messages when an input or relay changes state, when a particular Sensor value is reached, or when the supply voltage is out of the desired range. The SNMP Trap must be configured for each Relay, Input, and Sensor in the setup pages. The following Traps are supported:

Relay Traps

A change in state of the relay will cause the X-332™ to send a Trap message.

Object	Description	Value
X332.75	Relay one state change.	0 or 1 (0 – OFF, 1 – ON)
X332.76	Relay two state change.	0 or 1
X332.77	Relay three state change.	0 or 1
X332.78	Relay four state change.	0 or 1
X332.79	Relay five state change.	0 or 1
X332.80	Relay six state change.	0 or 1
X332.81	Relay seven state change.	0 or 1
X332.82	Relay eight state change.	0 or 1
X332.83	Relay nine state change.	0 or 1
X332.84	Relay ten state change.	0 or 1
X332.85	Relay eleven state change.	0 or 1
X332.86	Relay twelve state change.	0 or 1
X332.87	Relay thirteen state change.	0 or 1
X332.88	Relay fourteen state change.	0 or 1
X332.89	Relay fifteen state change.	0 or 1
X332.90	Relay sixteen state change.	0 or 1

Input Traps

When an input on the X-332™ changes state, a Trap message will be sent.

Object	Description	Value
X332.95	Input one state change.	0 or 1 (0 – OFF, 1 – ON)
X332.96	Input two state change.	0 or 1
X332.97	Input three state change.	0 or 1
X332.98	Input four state change.	0 or 1
X332.99	Input five state change.	0 or 1
X332.100	Input six state change.	0 or 1
X332.101	Input seven state change.	0 or 1
X332.102	Input eight state change.	0 or 1
X332.103	Input nine state change.	0 or 1
X332.104	Input ten state change.	0 or 1
X332.105	Input eleven state change.	0 or 1
X332.106	Input twelve state change.	0 or 1
X332.107	Input thirteen state change.	0 or 1
X332.108	Input fourteen state change.	0 or 1
X332.109	Input fifteen state change.	0 or 1
X332.110	Input sixteen state change.	0 or 1
X332.111	Input seventeen state change.	0 or 1
X332.112	Input eighteen state change.	0 or 1

Analog Traps

An SNMP Trap message can be sent when the analog alarm boundaries are crossed.

Object	Description	Value
X332.120	Analog one alarm.	xxx.x
X332.121	Analog two alarm.	xxx.x
X332.122	Analog three alarm.	xxx.x
X332.123	Analog four alarm.	xxx.x

Sensor Traps

Two alarm thresholds can be configured for each sensor. An SNMP Trap message can be sent when the temperature boundaries are crossed. See **2.3.9 Sensor Tab** for more information on configuring the sensor alarms.

Object	Description	Value
X332.65	Sensor one alarm.	xx.x
X332.66	Sensor two alarm.	xx.x
X332.67	Sensor three alarm.	xx.x
X332.68	Sensor four alarm.	xx.x

Password

X-332™ uses the Control Password for both the read and write community strings. If the Control Password is disabled, any object can be read without the need for a correct community string. By default the Control Password is `webrelay`.

Appendix G: BASIC Scripts

BASIC (Beginners All-purpose Symbolic Instruction Code) is a computer programming language that has been in use for many years. The X-332™ has an integrated BASIC interpreter for simple BASIC scripts. This provides a great deal of flexibility by allowing users to customize basic functions of the unit. The interpreter only supports a small subset of the BASIC commands that are available for computers. Some non-standard commands have been added, and some commands may function differently on the X-332™ BASIC interpreter than on other platforms. The following is a short tutorial on the supported BASIC functions.

Contact customer support if further assistance is required.

Structure

A BASIC script is written as a .txt file, which is then uploaded to the device using the **Script** setup tab. The maximum script size is 2 kbytes. Each line within the script contains a single statement. Line numbers are not used.

Statements are not case sensitive; however, variables are.

IF THEN, FOR loops, and DO loops can only be nested up to 5 times per command. For those not familiar with nesting, the following is an example of nested FOR loops:

```
FOR a = 0 to 100
  FOR b = 0 to 100
  NEXT b
NEXT a
```

Every program must end with an END statement. Subroutines would then follow after the END statement, if required. The last line of the script should be left blank.

Line Format

Every line follows the same format. The basic format is:

statement (variable) (=, <, >, <=, >=, <>) (expression) (THEN)

The fields in parentheses are optional depending on the statement. Spaces must be used between all statements, numbers, variables, operators, expressions, etc. Multiple spaces are valid. Comments may be inserted, but must begin with an apostrophe. All text on a line after the apostrophe is ignored.

Examples:

```
LET a=1             'this will return an error because of insufficient spacing
LET a = 1           'this is valid
LET a  =  1         'this is valid
```

Only a single variable or literal is allowed on the left side of any operator. The following example is incorrect and will return an error. The error occurs because there is more than a single value to the left of the comparison operator (a + 2 is to the left of =).

```
IF a + 2 = 3 THEN  'this will return an error
```

To fix the above line, replace 'a + 2'. One of the following options may be used:

```
IF a = 1 THEN
LET b = a + 2
IF b = 3 THEN
```

Supported Statements

The following are the statements supported by the ControlByWeb™ BASIC interpreter.

LET

The LET statement assigns a variable a value. The format is:

LET (variable) = (expression)

IF THEN, ELSE, END IF

The IF THEN statement tests the truth of a condition. The ELSE statement defines a second function if the condition is found false. In other words, if the condition is true, then a function is performed. If it is not true, a second function may be performed. The second function may or may not be necessary depending on the application. The IF THEN (ELSE) statement must always be followed with an END IF statement. The format is:

IF (variable) (=, <, >, <=, >=, <>) (expression) THEN
(Function 1)
ELSE
(Function 2)
END IF

Note: In most BASIC interpreters, 'Function 1' (see above) may be placed after the THEN statement. This interpreter requires 'Function 1' to be put on the following line.

FOR TO, NEXT

The FOR TO statement loops a section of code a predefined number of times. The NEXT statement always follows the section of code to be looped. The format is:

FOR (variable) = (expression) TO (expression)
(code to be looped)
NEXT (variable)

DO WHILE, LOOP

The DO WHILE statement loops a section of code while a condition is found true. The LOOP statement always follows the section of code to be looped. Note that if the condition is omitted, the code will be looped without end. The format is:

DO WHILE (variable) (=, <, >, <=, >=, <>) (expression)
(code to be looped)
LOOP

Example:

```
let t0 = 100
do while t0 > 0
    ' wait
loop
```

LOG

The LOG statement causes the device to log data according to the settings specified under the **Logging** setup tab.

*Note: In order to log, logging must be enabled in the **Logging** setup tab.*

The format is: LOG

EMAIL

The EMAIL statement causes the device to send an email of the same format as that generated by other status change and alarm conditions. The event that triggered the email is given, followed by the I/O or Sensor that you want to email. The format is:

EMAIL (feature state – relayX, inputX, tempX, anaX) 'X represents the feature number such as relay2

Examples:

```
   EMAIL        'Status email sent to addresses listed under Network tab.
...or...
   EMAIL relay2 'Sends state change message to emails setup in I/O tab.
...or...
   EMAIL input1 'Input state change message to emails setup in I/O tab.
...or...
   EMAIL temp2  'Temp alarm message sent to recipients in the Sensors tab.
```

END

The END statement ends the main body of code.

CALL

The CALL statement is found within the main body of code, but requires the interpreter to skip to a subroutine found at the end of the program. After the subroutine is finished, the interpreter returns to the line immediately following the CALL statement. The format is:

CALL (name of subroutine)

SUB, END SUB

The SUB statement defines the beginning and name of a subroutine. The END SUB statement defines the end of the respective subroutine. Subroutine names can be up to 20 characters long and are case sensitive. The SUB and END SUB statements always must follow the END statement. The format is:

```
END

'*** Subroutines Go Here ***
SUB (name of subroutine)
  (contents of subroutine)
END SUB
SUB (name of subroutine)
  (contents of subroutine)
END SUB
```

REM or '

The REM or apostrophe (') statement designates remarks made by the programmer. The interpreter will disregard any characters on the line following these statements.

PRINT

The PRINT statement displays a variable or message to the display. The PRINT statement is only available for the PC version of the BASIC interpreter. The device will not recognize the command since it does not have an operator display. The format is:

PRINT (variable) 'show variable value to screen

PRINT "(message)" 'show '(message)' to screen

User-Defined Variables

Two types of variables are available for use in the ControlByWeb™ BASIC interpreter, user-defined variables, and predefined variables.

Up to 10 user variables may be initialized. These must be single character, lower case letters.

a, b, c, d, e, f, g, h, i, j

They are always global and stored internally as floating point numbers. Variables are defined using the LET statement.

Examples:

```
Let b = 5           'variable b will be set to 5
Let d = b + 2       'variable d will be set to 7
```

Predefined Variables

The following are useful predefined variables for the ControlByWeb™ BASIC interpreter. These are useful for accessing internal values and features states.

Timer Variables

Six timers are available for use in BASIC scripts.

t0, t1, t2, t3, t4, t5

Timers can be set to any positive integer (or 0) by using the LET statement. As soon as a value is assigned to a timer, it will begin to count down immediately by decrementing one count every 100 ms until it reaches zero.

Examples:

```
Let t3 = 1500       'set timer 3 to 150 seconds
Let t1 = 0          'disable time 1
```

Relay Variables

Relay variables represent the state of the relays and can be used to change the state of the relays. Remote relays can also be controlled, but not read. The following variables are available.

relay1 'relay 1
. .
. '
relay16 'relay 16
rmt_relay1 'remote relay 1
. .
. .
rmt_relay3 remote relay 3
.
.
.
rmt_relay16 'remote relay 16

Note: Commands can be sent to remote relays, but the states of those relays cannot be read. Consequently, remote relays should not be used in safety or security-critical applications.

Relay outputs can be turned ON, turned OFF, pulsed, toggled, or read in BASIC scripts. The LET statement is used to set the output state. The state options available are:

0 – turn relay off
1 – turn relay on
2 – pulse relay
5 – toggle relay

The pulse time is specified in the **Relay** setup tab.

Examples:

```
Let relay1 = 1      'turn on relay 1
Let relay2 = 0      'turn off relay
Let relay1 = 2      'pulse relay 1
Let relay2 = 5      'toggle relay 2
Let a = relay2      'read the state of relay 2, state will be 0 or 1
```

Input Variables

The digital input states can be read in BASIC scripts.

input1	'digital input 1
input2	'digital input 2
input3	'digital input 3
input4	'digital input 4
.	.
.	.
input16	'digital input 16

Example:

```
Let a = input1      'sets 'a' equal to value of input 1
```

Counter Variables

The input counters can be read in BASIC scripts.

count1	'counter input 1 (input 17)
count2	'counter input 2 (input 18)

Example:

```
If count1 > 5000 Then      'If input counter 1 is greater than 5000 then
      Let relay1 = 1       'turn output 2 on
End If
```

Analog Variables

The analog input scaled values can be read in BASIC scripts.

ana1	'analog input 1
...	'ana2, ana3
ana4	'analog input 4

Example:

```
If ana1 > 4 Then           'If Analog Input 1 is greater than 4 then
      Let relay1 = 2       'Pulse output 1, otherwise
Else
      Let relay1 = 0       'output1 will be off
End If
```

Temperature/Humidity Sensor Variables

Each temperature sensor or humidity sensor can be read in BASIC scripts.

temp1	'temp or humidity sensor 1
temp2	'temp or humidity sensor 2
…	
temp4	'temp or humidity sensor 4

Example:

```
If temp2 >= 80 Then        'If temperature sensor reads greater than 80
                           ' degrees, then
  Let relay2 = 1           'Turn on relay 2
End If
```

Date and Time Variables

The variables 'time' and 'date' are predefined, read only variables that store the current date and time. They can be used to schedule events and activities, such as sending emails, reading temperature, or setting Outputs. The date uses the mm/dd/yyyy format. Clock time is formatted as hh:mm:ss (24-hour clock).

Example:

```
If date = 01/01/2014 Then
  If time > 12:30:00 Then
    Let relay2 = 1
    Let relay3 = 0
  End If
End If
```

*Note: Current date and time can only be set in the **Date/Time** tab.*

Event Variables

Data and time variables can be used to execute script events.

Up to five date variables are available.

ed1	'event date variable 1
…	'ed2, ed3, ed4
ed5	'event date variable 5

The value assigned to event variables should be in the format mm/dd/yyyy. The event date variables store the number of days that have passed since January 1, 1970.

Event time variables may be used in math expressions as well as comparison statements.

Time variables have a similar naming convention.

et1	'event time variable 1
...	' et2, et3, et4
et5	'event time variable 5

Event time variables are declared in the format hh:mm:ss in 24-hour time. The event time variables store the number of seconds from the beginning of the day.

Event date and event time variables of the same number are linked. If the event time variable is incremented more than the number of seconds in a day (86400 seconds), the variable is reset to 0 and the event date variable is incremented by one. For example, if et3 rolls over to zero, ed3 will be incremented.

The following script example demonstrates defining the event variables and comparing it to the current date and time. Assume current time is April 10, 2010 at 1:30 AM and the event should occur in one hour

and every hour thereafter.

Example:

```
Let a = 1
Let ed1 = 04/10/2010            'sets the event date to April 10,
                                '2010.
Let et1 = 02:30:00              'sets the event time to 2:30
Do While a <> 0
  If ed1 >= date Then           'Tests event date versus current date.
    If et1 >= time Then         'Tests event time versus current time.
      Let et1 = et1 + 3600      'Increments the event time by one hour
                                '(in seconds).
      Print "Event"             'Event to occur
    End If
  End If
Loop
End
```

External Variables

External variables are similar to general purpose variables and can be used in the same manner. The difference between general purpose variables and external variables is that external variables can be accessed by the user through a web browser and modified while the script is running. Scripts can use external variables as a method of retrieving user input.

extvar0 'external variable 1
… 'extvar2, extvar3, extvar4
extvar4 'external variable 5

The following example demonstrates this by creating a script that will turn Output 1 ***ON*** if extvar1 equals 1 and turn Output 1 ***OFF*** if extvar1 equals 0.

Example:

```
Do
  If extvar1 = 1 Then
    Let rmt_relay1 = 1
  Else
    Let rmt_relay1 = 0
  End If
Loop
End
```

External variables can also be used to show numeric values, such as a count down timer. If the extVar is any other value than 1 or 0, the value will be displayed in the Status 2 column, with a gray background. See section **2.4.13 Script Tab** for instructions on configuring external variables for visibility on the **Control Page**.
The following code will show a count down from 10 seconds and automatically restart. The refresh rate must be configured in the **Control Page Setup** in order to see each of the count down values.
Example:

```
let t0 = 10                     'Initialize variables and start timer
let extvar0 = 10

'Main Loop
Do
      if t0 = 0                 'when timer reaches 0 decrement counter
            let extvar0 = extvar0 - 1
            let t0 = 10
      end if

      if extvar0 < 0            'restart when counter reaches zero
            let extvar0 = 10
```

```
        end if
loop
end
```

Extvar1 can be set and cleared by entering the following requests into a web browser or by configuring on and off buttons to appear on the **Control Page** for extvar0:

```
http://192.168.1.2/state.xml?extvar1=1
http://192.168.1.2/state.xml?extvar1=0
```

Testing and Debugging

A copy of the BASIC interpreter for Windows is also available on our website for the use of testing and debugging. The X-332™ will only acknowledge errors as it runs. This means that if a path of the script is not encountered, errors may still exist. The Windows version of the interpreter, however, will check for errors before the script is run.

The PRINT function is available for use with the Windows version of the BASIC interpreter. The interpreter on the device, however, will not recognize this command.

Note: The script will be restarted by submitting any of the setup pages or by power cycling the unit.

MISSING END OF LINE error may be caused by misspelled names or a program that is too long. 1900 bytes of memory is reserved for BASIC scripts. Each text character, space, punctuation mark, tab, or carriage return uses one byte. If the script is too long, the script will be truncated and will not function as desired.

Appendix H: Specifications

Power Requirements

- Voltage Input:
  - **Model X-332-24I** : 9-28 VDC
- Current: See table below for typical values at 25°C.

***10 Mbps* Network Speed, 28VDC Applied to Inputs, +5Vout Applied to Analog Inputs**

Power Supply	No Relays On No Inputs On	8 Relays On 8 Inputs On	16 Relays On 18 Inputs On
9 VDC	184 mA	567 mA	1.012 A
12 VDC	142 mA	429 mA	734 mA
16 VDC	116 mA	322 mA	540 mA
24 VDC	83 mA	220 mA	363 mA
28 VDC	74 mA	192 mA	316 mA

***100 Mbps* Network Speed, 28VDC Applied to Inputs, +5Vout Applied to Analog Inputs**

Power Supply	No Relays On No Inputs On	8 Relays On 8 Inputs On	16 Relays On 18 Inputs On
9 VDC	282 mA	690 mA	1.161 A
12 VDC	216 mA	504 mA	819 mA
16 VDC	166 mA	377 mA	602 mA
24 VDC	116 mA	261 mA	407 mA
28 VDC	104 mA	227 mA	351 mA

I/O Connector

- 3-position, removable terminal strip, 3.81 mm spacing
  (Replacement part number, Phoenix Contact 1757022)
- 8-position, removable terminal strip, 3.81 mm spacing
  (Replacement part number, Phoenix Contact 1803633)
- 5-position, removable terminal strip, 3.81 mm spacing
  (Replacement part number, Phoenix Contact 1803604)

I/O:

-16 Relays, 16 Optically Isolated Inputs, 2 Counter Inputs (inputs 17 and 18), 4 Analog Inputs, 1-Wire bus

Relay Contacts:

- Contact Form: SPST (form A)
- Contact Material: AgNi
- Contact Resistance: 125 milli-ohm max

- Internal Relay Mechanical Endurance: 5,000,000 operations min. (under no load)
- Internal Relay Electrical Endurance: 100,000 operations average (under rated load)
- Max Voltage: 30VAC, 30VDC
- Max Current: 2A
- Contact Protection: 40V MOV

Optically Isolated Inputs:

- Vin MAX: 26VDC
- Vin HI: 11V (min)
- Vin LO: 1.0V (max)
- Current: 4.7-25mA
- Minimum Hold Time (high or low): 20mS
- Input Functions: Monitor State, Control Relays, Control Remote Relays, High Timer

Counter Inputs:

- Vin MAX: 5VDC
- Vin HI: 2.8V (min)
- Vin LO: 1.0V (max)
- Internal Pullup: 47K
- Current: 4.7-25mA
- Input Functions: Count, Monitor State, Control Relays, Control Remote Relays, High Timer

Analog Inputs:

- 4 Single-ended Channels
- Input: 0-5VDC
- Resolution: 12-bit
- Reference: 5.000 ± 10mV, 8ppm, 10mA MAX
- Sampling Rate: 2s

Temperature/Humidity Sensors

- 4 Sensors maximum
- 600 ft (180 m) maximum combined cable length

Temperature Sensors

- “1-Wire” Digital Thermometer (Dallas Semiconductor DS18B20)
- Range: -55°C to +125°C (-67°F to +257°F)
- Accuracy: +/-0.5°C from -10°C to +85°C

Humidity Sensors

- “1-Wire” Digital Sensor
- 0-100% RH +/- 1.8%

Network

- 10 Base-T or 100 Base-T Ethernet IPv4
- Static IP address assignment or DHCP
- HTTP port selectable
- Standard 8-pin RJ-45 Modular Socket
- Supports Web Browser (HTTP), XML, Modbus/TCP, SNMP protocols

35 LED Indicators

- Power On

- Relays (1-16)
- Inputs (1-16)
- Network Linked
- Network Activity

Real-Time Clock

- Manual or NTP (Network Time Protocol) setup
- NTP Sync Configurable for Once, Daily, Weekly, or On Power-up
- Automatic Daylight Savings Adjustment
- Battery (capacitor) Power Backup

Capacitor Power Backup

- Supports Real-Time Clock, External Variables, Output State
- 3 days Minimum Duration

Nonvolatile Memory

- Flash Memory
- All user settings are stored in nonvolatile memory. Settings will not be lost when power is disconnected.

Environmental

- Operating Temperature: -40ºC to 65.5ºC (-40ºF to 150ºF)
- Storage Temperature: -40ºC to 85ºC (-40ºF to 185ºF)

Mechanical

- Size: 8.725 x 1.815 x 3.735 in. (221.6 x 46.1 x 94.9 mm), connectors not included
- Weight: 29.2 oz (827.8 g) without connectors
- Weight: 31.3 oz (887.3 g) with connectors

Logging

- Stored in Nonvolatile Flash
- Circular Buffer
- 512 kB (8382 to 23622 log entries depending on configuration)
- Unlimited data storage possible through web services.

Password Settings

- Password protection on Setup Page
- Optional Password protection on Control Page
- Base 64 Password Encoding
- 13 Character, Case-Sensitive Password Length

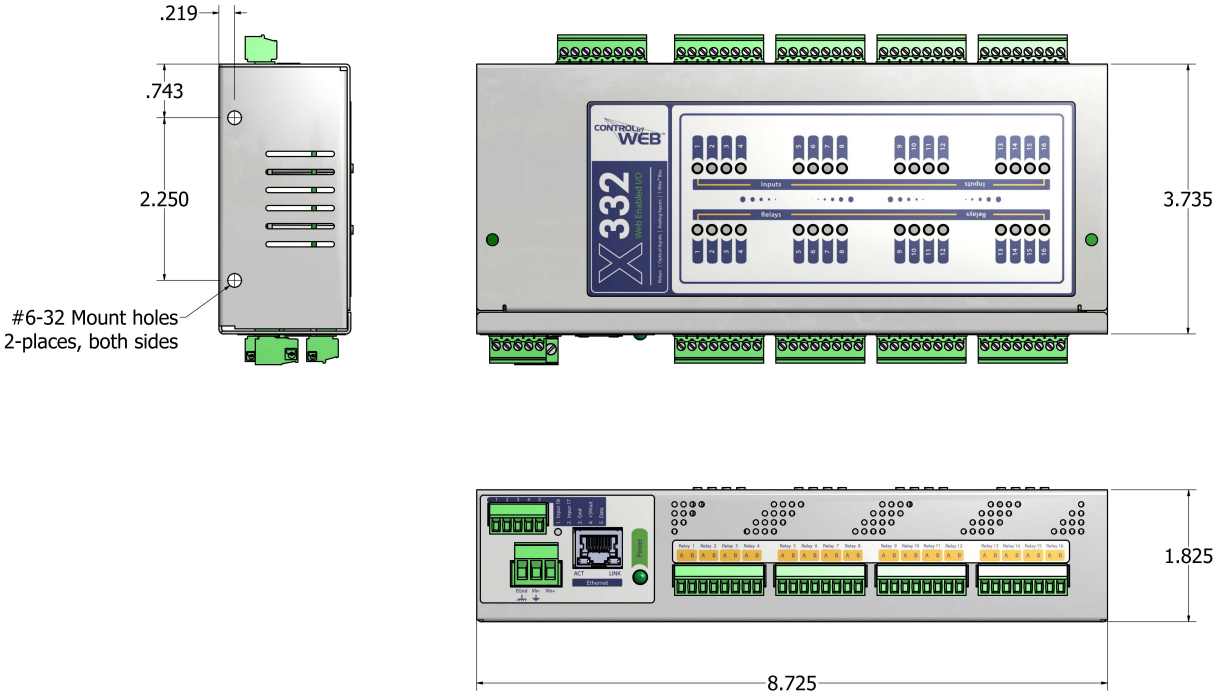
Electromagnetic Compliance

- IEC CISPR 22, CISPR 24
- FCC 47CFR15 (Class B)
- EU EN55024, EN55022

Product Safety Compliance

- IEC 60950-1 / EN 60950-1

Appendix I: Mechanical Information



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